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The Hyphenated Metallurgist

Dr. White, of the Refractories Department of Sheffield University, in a lecture to a local metallurgical association, made out a strong case for the retention of the traditional aspects of metallurgy. A metallurgist can be defined as an individual who extracts metals from the ores and supervises the subsequent working into articles of commerce. To carry out his professional duties he has need to have a knowledge of chemistry, physics and mathematics, plus—and this is very important—a profound insight as to how these sciences have been applied in the past to produce the great metallurgical industries as we know them to-day. Dr. White did not seem to welcome some of the modern theories which emanate from the brains of the metal physicists, as he considered industry by and large was not quite ready to receive them. Maybe industry feels that it has not yet received its full benefit from the traditional metallurgist.

Dr. White cited the case of Birmingham University, wherein there are now four professors of metallurgy. We quote his words: "One Professor of Metallurgy (undefined, and presumably administrative); one Professor of Industrial Metallurgy; one Professor of Physical Metallurgy and one Professor of Metal Physics. . . . I hope, however, that some training in all three branches will be given to all students so that they can at least understand each other's language." We remember the vice chancellor of one of the newer universities giving us privately as his view that if a man had a good science degree, then a year in industry would convert him into a perfectly good metallurgist. Our view is that if a firm wants a chemist, a metallurgist, or a physicist—and there is room for all three in the largest installations—let them "hire" them as such, define their duties, and let them get on with their jobs.

It should be appreciated that no matter what a man's basic training has been, he possesses natural aptitudes, and special interests. Some will absorb the higher branches of physics, whilst others will acquire the practical skills. All must learn the need for the economic production of material to "better than standard" quality. This effort is very largely governed by the customer. Ever since the industrial revolution, the users of metals and alloys have been making ever-increasing demands for greater hardness, for acid-, heat- and corrosion-resisting material; for surfaces which will enamel or electroplate more satisfactorily. These advances have so far been made by the metallurgist, the physicist, the ceramist, and the practical man working in harmony. Whether the newer hyphenated metallurgist will do better still remains a query. A young friend of ours—a qualified civil engineer—was given what to our mind was a really fascinating mechanical engineering job, showing wonderful prospects, yet he was disgruntled. The hyphenated metallurgist, to be of real service to industry, may be required to forget what are, after all, rather limiting adjectival qualifications.

The New Parliament

So far as the foundry industry is concerned, the major interest to be associated with the new Parliament is the fact that the Act for turning the iron and steel industries into a State monopoly is on the Statute Book. The vesting date is fixed for October 1 this year, with implementation on January 1, 1951. Whether this will come to pass, only the future can show. The even strength of the two major parties should enable the politicians to practise what they preach to industry—that is, joint consultation for the benefit of all concerned. There is so much to do in this direction that highly controversial measures can best be postponed until a true mandate has been given by the electorate. The economic crisis still exists, and real statesmanship will be needed to avoid a major catastrophe when Marshall Aid finishes.

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Leaders of the Industry

G. B. Judd

Mr. Geoffrey B. Judd is of the second generation of a firm of chartered accountants, Mann, Judd & Company, which has taken a live interest in the foundry industry, for his father, Mr. H. Judd, C.B.E., was associated for many years with the activities of the National Ironfounding Employers' Federation. This association is now in the hands of Mr. G. B. Judd, who also similarly serves the South of England Ironfounders' Association. Though really a Londoner, Mr. Judd was born in Glasgow. He was educated at Greshams, Holt, Norfolk—a school which does not confine itself to the classics, but includes instruction in science. Later he was a student at Jesus College, Cambridge, where he took Part I of the Tripos and obtained honours in chemistry, physics and physiology. He then passed with honours Part II of economics. After three years' apprenticeship with Mann, Judd & Company, he was appointed a partner in 1939. During the war, he obtained a commission in the Royal Artillery, and, on being transferred to the Ministry of Supply, was engaged on experimental work on guns, and later on tank armour and turret castings. This involved the accurate measurement of the projectile velocity to dent and to penetrate various types of armour.

MR. G. B. JUDD

He returned to his professional duties in 1946 and, amongst his various activities, found those associated with the foundry industry to hold a major interest. He seems to have an innate knowledge of castings and is exceptionally keen on seeing that those who make them should know their real cost. He was particularly active upon the South of England Ironfounders' Association Committee which visited and reported upon so many of the members' works. His visit to America as Secretary of the General Ironfounders' Productivity Team should well qualify him for the title of "Foundryman" *honoris causa*.

Latest Foundry Statistics

According to the January issue of the Bulletin of the British Iron and Steel Federation, the average number of people employed in ironfoundries during the week ending December 10, 1949, was 146,352, an increase of 782 (of whom 102 were females) over the previous month. The situation in steelfoundry employment numerically was almost static, a gain of two people being registered, although this has involved a loss of 44 men and a gain of 46 women. The average weekly delivery of steel castings in December was 4,300 tons, as against 4,600 in November. The liquid steel melted during December, also expressed as a weekly average, was 8,000 tons.

Forthcoming Events

MARCH 6

Institute of British Foundrymen.

Sheffield Branch :—"Design to Despatch," by J. G. Bailes, at the Royal Victoria Station Hotel, Sheffield, at 7.30 p.m.

MARCH 7

Institution of Works Managers.

London Branch :—"The Application of High-speed Photographic Techniques to Industrial Problems," by J. Hadland, at the Royal Socity of Arts, John Adam Street, London. W.C.2, at 6.45 p.m.

MARCH 9

Institute of British Foundrymen.

Lincolnshire Branch :—Open Meeting, at the Lincoln Technical College, at 7.15 p.m.

East Anglian Section :—"Where is Cast Iron Going To?" by P. A. Russell, at the Central Hall, Public Library, Ipswich, at 7 p.m.

MARCH 10

Institution of Production Engineers.

West Wales Sub-section :—"The Effective Use of Metals," by Dr. E. G. West, at the Central Library, Alexandra Road, Swansea, at 7.30 p.m.

MARCH 11

Institute of British Foundrymen.

Scottish Branch :—"Cylinder Work," by D. Redfern, followed by the Annual Business Meeting, at the Royal Technical College, George Street, Glasgow, at 3 p.m. The Annual Dinner will be held in the Grosvenor Restaurant after the meeting.

Newcastle Branch :—Discussion—"Trial by Jury," at the Neville Hall, Westgate Road, Newcastle-upon-Tyne, at 6 p.m.

Forty Years Ago

In our issue of March, 1910, there was an announcement of the establishment of a Scottish Branch of the Institute of British Foundrymen. The main topic of interest was whether pig-iron could be sold to analysis. The most enlightening contribution was from Mr. Peter Donaldson, representing the Scotch Pig-iron Trade Association, who said that "by analysis" was the correct method but that was not yet possible. Other people, who should have known better, said it was impossible commercially. This issue described and illustrated a 77-ton steel casting—a stern-post frame—made by Darlington Forge for the White-Star Line, being taken to the coast. There were also articles by Dr. Percy Longmuir on steel castings, portraying very accurately the state of the art at that time; on dust removal; snap-flask practice, by Mr. J. E. Moorhouse; and more "tripe" from J.F.P.L. on steel additions to cast iron. Amongst new companies registered was Highton & Son, Limited.

MR. R. R. STOKES, M.P., chairman and managing director, Ransomes & Rapier, Limited, Ipswich, has been appointed Minister of Works in the new Government. Mr. Stokes, who is 53, was awarded the French *Croix de Guerre* and the Order of the Nile in the 1914-18 war and is well known in foundry circles, as his company operates a large foundry.

AGA HEAT, LIMITED (Proprietors, Allied Ironfounders, Limited), North Audley Street, London, W.1, have designed and placed in the market a new type of domestic boiler. Vitreous-enamelled cast iron is incorporated in the front, top and as fittings. This was shown to the Press on February 28, on the occasion of the opening of new showrooms in North Audley Street, which event also coincided with the coming-of-age of the company.

Four Centuries of Bell Founding

By A. Graham Thomson

In 1970 the Whitechapel Bell Foundry will celebrate its fourth centenary, but its roots stretch back even further into English history, for its second master founder, Joseph Carter, of Reading, learnt his craft at a Wokingham foundry which was established in the 14th century. Throughout its long existence the foundry has specialised in the casting of church bells, a record of continuous achievement which is believed to be unsurpassed by any other British firm.

It was in 1570 that this historic foundry, birthplace of some of the most famous bells in England, was established at its original site in Whitechapel High Street, London. Quite a number of the bells cast by its founder, Robert Mott, are still in service. Among them is the sixth bell of the peal at St. Mary's, Wimbledon, which was cast in the period 1570 to 1572.

Mott's kinsman and successor, Joseph Carter, was the last of the old Wokingham founders. From Wokingham he went to Reading, where he carried on a mediæval foundry for some years. When Mott began to think of retiring, Carter joined him, and a few years after Mott's death he closed down the Reading foundry and concentrated all his attention at the Whitechapel premises.

In 1728, the foundry was moved from the north side of the High Street to its present site at 32, Whitechapel Road, not very many yards away. This site was formerly occupied by an inn called "The Artichoke," the original wine cellars of which still remain. Still standing in the yard are a water tank and pump dated 1670, which belonged to the inn.

Recent History

Coming to more modern times, the foundry has belonged for generations to the family of the present owner, Mr. A. A. Hughes, whose two sons are both in the business, so that the continuity of ownership seems assured for many years to come. In the possession of Mr. Hughes is an example of one of the original founder's marks stamped with the initials R.M. The present owner's mark is based substantially on the same design, except that the initials have, of course, been changed.

At the Whitechapel Bell Foundry were cast a very large proportion of the church bells in central London and the surrounding districts, including the famous Bow Bells. All the bells in Westminster Abbey were cast at Whitechapel, one of them in 1583 and another in 1597. Another product of this foundry is Big Tom of St. Paul's Cathedral, which weighs 5¼ tons and is only tolled on the death of a monarch, a Bishop of London, or a Lord Mayor. A portion of the agreement with the Dean and Chapter is preserved in the office. The largest bell ever produced at the foundry is Big Ben, which is 9 ft. across the mouth, 7 ft. 6 in. high and weighs 13½ tons. This bell was cast in 1858.

One of the most famous bells in the United States is the Liberty Bell. This was first cast at Whitechapel in 1752. It was hung by local people but became cracked soon after hanging, for reasons which are unknown. It was recast facsimile in Philadelphia by a local

FIG. 1.—STRICKLING A BELL CORE IN LOAM SAND ON A BRICK FOUNDATION. NOTE HOW THE MOULD PARTS ARE CARRIED ON TROLLEYS.

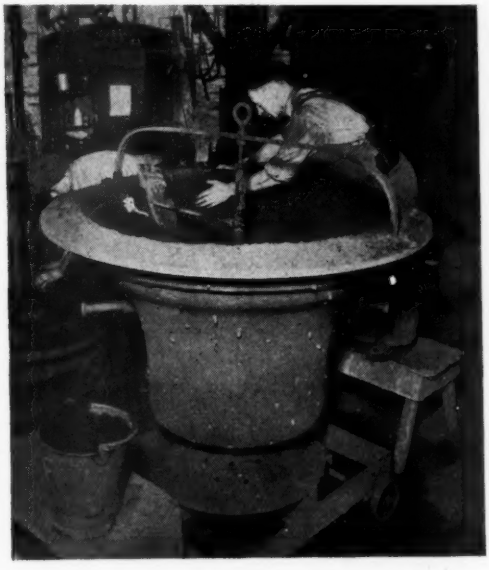


FIG. 2.—PREPARING THE COPE OF A BELL MOULD. LOAM SAND IS STRICKLED TO SIZE INSIDE A PERFORATED CAST-IRON FORMER.

FIG. 3.—CLOSING THE MOULD; THE DRESSED CORE IS CARRIED ON A BASEPLATE AND THE COPE PART IN THE CAST-IRON FORMER IS LOWERED OVER IT.

FIG. 4.—IMPRESSING THE SUBSCRIPTIONS ON THE INSIDE OF A BELL.

foundry, but cracked again, and is now on show in Philadelphia.

Among the most notable products of recent years are a peal of twelve bells for Liverpool Cathedral, which were completed early in the war but have not yet been hung. When in service they will constitute the heaviest ringing peal of twelve bells in the world.

Church bell metal is an alloy consisting of only copper and tin. One of the most important points in making a church bell is so to design the shape that the main tone and the various harmonic tones are all perfectly in tune. Any small error caused in moulding is corrected in a vertical lathe by paring metal from the inside.

Moulding of Bells

Church bells are moulded in loam and patterns are not used. Fundamentally, the principles of bell founding have remained unaltered since the days of Robert Mott. Until comparatively recent times the procedure was as follows:

First the core for the inner shape of the bell was made in a pit, being strickled up and dried by means of a charcoal fire inside the mould. When the core was completed an exact replica of the bell required was strickled up on the core. After this replica or "thickness bell" in turn was dry, the cope was built on the thickness. When the whole mass was perfectly dry the cope was lifted and the thickness bell destroyed. The core was then re-dressed. Any lettering or ornamentation was pressed into the cope and the whole mould was again dressed. When everything was ready, the copes were lowered into place over the cores and the pit was filled with earth, which was rammed down tightly to prevent the cope from lifting when the molten metal was poured in.

Modern procedure differs in certain important respects. Nowadays, the core is struck up in very much the same manner, except that it is not made in a pit. The cope consists of an iron casing cast approximately to the shape of the bell and covered all over with a series of vent holes. The iron case is lined with loam and strickled to shape from a centre. When these preparations have been completed and everything is perfectly dry, the cope is lowered over the core. The two posts are clamped together and are then ready to receive the molten metal. The principal advantages of the modern method are that it is no longer necessary to use a thickness bell and the iron case lined with clay can be used over and over again instead of an entirely new clay cope having to be made for each casting. Not only is the current procedure very much faster, but it also gives more accurate results. Figs. 1 to 5 show stages in the modern process.

Knowledge of the various harmonic tones in bells is now very much greater than it was four hundred years ago. This progress, together with more precise methods of moulding, has enabled much greater uniformity in quality to be attained. Although some master founders of the 16th century were able to achieve a wide reputation for the production of good peals of bells, their products used to vary much more in quality than do the bells produced to-day.

Inside the front entrance of Mears & Stainbank, under which title the business is now carried on, is a veritable museum of bell founding. Immediately behind the door is a complete sectional outline of Big Ben. There is a photograph of the earliest type of church bell extant in Britain, which was cast about 1220 and now hangs in Skinners' Hall, London, E.C., having been restored to use. This bell is shaped like the flower of a foxglove, being much deeper and narrower than the 16th century product, which was cast

in very much the same shape as a modern bell. The collection includes the inscription band from a bell cast about 1350 on which letters have been cut in relief, a magnificent example of mediæval craftsmanship. Of outstanding interest is a collection of stamps cut from ancient British bells.

Present Conditions

Ever since the war ended, the Whitechapel Bell Foundry has been working to capacity. The repair of war damage has not yet started, but there is a very large backlog to be overtaken and orders are being received from all over the country for deferred repairs, re-casting and re-hanging old peals, as well as additions and new peals.

FIG. 5.—BELL MOUNTED ON A VERTICAL LATHE FOR TUNING.

In the yard of the Early Georgian building, in which the foundry has been housed for more than two hundred years, are numerous bells ranging from 16th century veterans awaiting repairs and re-hanging to a new peal cast recently for a church in Yorkshire. Inside the foundry, old bells are re-tuned on a special-purpose vertical lathe, an operation which has to be done with absolute accuracy. In mediæval times all tuning was carried out with a hammer and chisel, the marks of which are clearly visible on the inside of ancient bells. The oldest piece of equipment still in use is a hand lathe, parts of which are between 150 and 200 years old. This machine has been converted to motor-drive and is now used for tuning hand bells. These are cast from much the same metal as church bells but with a lower tin content, the finished casting being buffed and burnished to produce a very high polish.

Church bells cast at the Whitechapel Bell Foundry are exported to many countries. Enquiries are received not only for large peals but also from mission stations in Africa and numerous small churches or chapels in every continent, for the Whitechapel bells are known throughout the world.

Besides the production of bells of all sizes ranging in weight from a few ounces up to several tons, the firm undertakes the manufacture of clappers and all other fittings, the erection and fabrication of bell frames, and the hanging of the peals. In fact, every type of work connected with bells is carried out. The pattern shop produces wheels, pulleys, frames and any other woodwork required. There is a structural shop where bell frames are fabricated in steel, both electric welding and gas cutting being undertaken in this completely self-contained establishment.

Foundry Conference

A foundry conference organised by the British Cast Iron Research Association will be held at Ashorne Hill, Leamington Spa, from March 30 to April 1. The following programme is tentative and there may be slight changes and modifications.

Thursday Afternoon, March 30.

The programme commences with opening remarks and a welcome by the President of the Association, Mr. P. H. Wilson, O.B.E., followed by a session devoted to chemical analysis, for which the main subjects will be:—Chemical laboratory layout and equipment; a note on sampling; significance and use of chemical results; methods of analysis (this part of the programme will deal with replies to questions), and the possible use of radio-active tracers in the foundry and in analytical methods. Additionally, some problems related to the production of light iron castings, including breakage in transit and its prevention, will be discussed.

Friday, March 31.

Under the general heading of shrinkage, porosity and related defects, the following will be dealt with:—

Shrinkage and porosity in cast irons (by A. A. Timmins); shrinkage and contraction in heavy castings; experiments with exothermic feeding compounds (communication from Cameron & Roberton, Limited); some new results on fluidity (by E. R. Evans), and discussion on shrinkage and porosity and related defects.

The next section concerns non-destructive testing and will include radiographic and gamma-ray methods for defects, and crack detection by magnetic methods.

Saturday, April 1.

A further session on light castings problems will include:—Corrosion in cast-iron boiling pans (by R. I. Higgins); rust-spotting on light castings (by R. Godding); rust prevention in cast iron (by W. Westwood), and low-phosphorus cast iron for light castings, enamelled and otherwise (by A. N. Sumner).

It will be seen from the programme that considerable time will be devoted to the discussion of certain subjects. Members who have any special problem to raise or who wish to discuss their own foundry experiences under (*a*) methods of chemical analysis, or (*b*) shrinkage, porosity and related defects, are particularly requested to send in some indication of their questions before the conference. Supplementary questions not submitted prior to the conference will, however, be dealt with as time permits. There will be a cinema performance at 8 p.m. on March 30 and March 31, with a change of programme on the second evening.

Founders Company Fellowships

The Worshipful Company of Founders of the City of London, to whom Ordinances were granted as long ago as July 29, 1365, was originally formed for the purpose of ensuring that work by founders in the City of London should only be with good metal. The Company believes that the development and progress of founding, and the science of metallurgy, must depend very largely on attracting to the industry highly trained men of evident talent. To that end the Company awards fellowships so as to give facilities for advanced education to men who have already completed their normal course of training—such training to have been at a university or to be at least of a high educational standard.

These Fellowships, which are called "Founders' Company Fellowships," are available to those candidates who appear likely to be able to make good their careers in the founding industry if afforded the facilities for further courses of study designed specially to qualify them towards that end. Fellows are chosen by a Selection Committee from among applicants who have completed such training as mentioned above, in chemistry, physics, metallurgy (more especially in connection with molten metal) and allied sciences. In addition to this, some previous practical foundry training and experience together with, if and when possible, the Diploma of the National Foundry College, would carry weight with the Selection Committee. At the same time, the Committee pays considerable attention to the character and powers of initiative of the candidate.

The course to be followed by the Fellow will in each case be chosen with the object of adding to his scientific equipment that which appears to be most necessary for adapting him to some branch of the founding industry. There will be no limitation to the nature of the course which may be selected; it might include research, a period in works or foreign experience, due regard being paid to the particular wishes and aptitude of the Fellow. The normal value of the Fellowship is £300 per annum and it will be renewable for a second year and in special cases for a third year. Payment will be made monthly in advance to the Fellow's bank.

One Fellowship is granted each year so that in ordinary circumstances there are two Fellowships in existence. The Fellow will be expected to devote his whole time to work approved by the Company and to submit periodical reports of progress, if required. No other work for which payment would be received shall be undertaken by him without the consent of the Master of the Company and no other grant, Scholarship or Fellowship shall be held concurrently with the Fellowship unless the Selection Committee approve. Candidates should not be less than 21 years of age on September 1 of the year of application and will be required to furnish particulars of their name, address, age, academic and other training, etc. They will subsequently be required to attend before the Selection Committee. The tenure of the Fellowship dates from September 1.

Applications must be received not later than May 1 by the Clerk of the Worshipful Company of Founders, Founders' Hall, 13, St. Swithin's Lane, E.C.4, to whom all inquiries should be addressed. The Company does not bind itself to award a Fellowship in any one year.

MR. F. J. THOMAS, previously manager of Auto-Malleable (Bingley), Limited, is leaving the West Riding of Yorkshire to start a new company, Criterion Malleable Foundries, at Wrexham.

Student's Grant

It will be recalled that early in 1949 the Council of the Institute of British Foundrymen expressed the opinion that there were ambitious, promising young men in the foundry industry whose studies and aspirations could be assisted by the provision of funds, and an offer was made to select a young man and to assist him financially in some manner appropriate to his experience, ambitions and needs.

As previously announced, a very satisfactory entry for the award was received and the selected candidate, Mr. Brinley Edwards, is utilising the grant to enable him to take a course at the National Foundry College.

From the applications received it was clear that the award met a widely-felt need, and it has therefore been decided to offer a further award for the current year.

Wide latitude will be allowed in the form of assistance which will be granted. It may, for instance, consist of bearing the cost of a course of study, or of a maintenance allowance whilst an approved investigation is carried out. In general, the award will be confined to men not exceeding 30 years of age, and will be for not more than one year.

Young foundrymen or students (whether members of the Institute or not) preparing for work within the foundry industry who desire to be considered for this award are invited to communicate with the secretary of the Institute. Unsuccessful applicants for the first award may again apply.

Full particulars should be given by the candidate, including name, age, address, present employer, a chronological account of previous experience, a chronological account of technical studies and full particulars of any investigational work carried out. Most important of all, the candidate should put forward a detailed account of the purposes to which he would apply any grant which might be made. It will be the endeavour of the Council to secure the co-operation of the selected candidate's employers to ensure him continuity of employment. Applications should be sent to the secretary of the Institute at St. Johns Street Chambers, Deansgate, Manchester, 3, as soon as possible, and in any event not later than June 1, 1950.

JOHN ROBSON (SHIPLEY), LIMITED, are planning to extend the foundry at St. Ives Street, Shipley.

THE 28TH ANNUAL MEETING of the Institution of Chemical Engineers is to be held at the May Fair Hotel, Berkeley Street, London, W.1, on April 14. The function will conclude with the Annual Dinner.

AN AGREEMENT has been reached between the managements and workers of the Dalzell works of Colvilles, Limited, the Lanarkshire Steel Company, Limited, and the Hallside works of the Steel Company of Scotland, Limited, to introduce, "for this year only," a new summer holiday period which will coincide with the Glasgow Fair. The re-arrangement is due to the fact that machinery for replacement and renewals of plant will not be ready in time for the normal holiday period.

CLEVELAND BRIDGE & ENGINEERING COMPANY, LIMITED, Darlington, and Dorman, Long & Company, Limited, Middlesbrough, are to share a contract to rebuild three bridges in Siam which were destroyed during the war. The Cleveland Bridge & Engineering Company are to fabricate and deliver all the steelwork (3,700 tons), while Dorman, Long & Company will dismantle the old bridges and erect the new ones. It is estimated that the work will take three years to complete.

Production and Use of Foundry Bonding Clay

Low-percentage Additions to Natural Moulding Sands

With the present-day emphasis on high production figures per moulding machine on mechanised and other plants, it requires only elementary mathematics to calculate the phenomenally-large tonnages of sand which have to be handled. A mechanised system of eight moulding machines each producing fifty 56-lb. half moulds per hour, requires to handle about 80 tons of sand per day (not taking spillage into account). The furnishing of this sand in the correct amount, of high quality and at low cost is not so simple a matter and has indeed provided cause for many foundry "headaches"; so much so, that it may truthfully be said that sand practice in the majority of foundries is gradually undergoing an evolutionary change. Gone are mixings by rule of thumb, additions of spots of this or drops of that in the hope that, *grace à Dieu*, the result would be satisfactory. Instead, floor sand, backing sand, facing, system, or core sand is compounded more and more on a scientific basis, to provide specific properties at low cost and with minimum waste. Perhaps one of the most significant changes has been the progressive adoption by many leading foundries of small additions of special clay to otherwise naturally-bonded base sands. This has neither been the prerogative solely of mass-production foundries, nor is it confined to the ferrous field—it seems to be a very widespread trend, having its origins in economy and betterment of quality of castings.

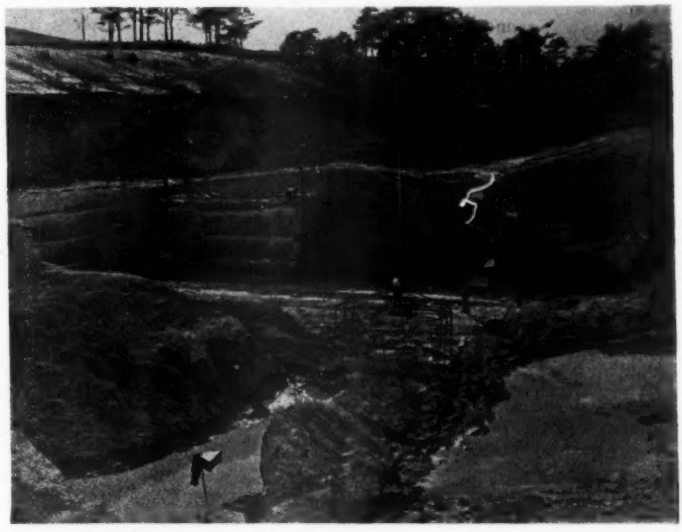


FIG. 1.—VIEW OF THE CLAY PIT IN DORSET, SHOWING THE AMOUNT OF OVERBURDEN AND THE METHOD OF WORKING.

It was with these thoughts in the background, that the writer recently paid a visit to the works of the Albion Pulverising Company, Limited, Birmingham, a concern specialising in the production and supply to

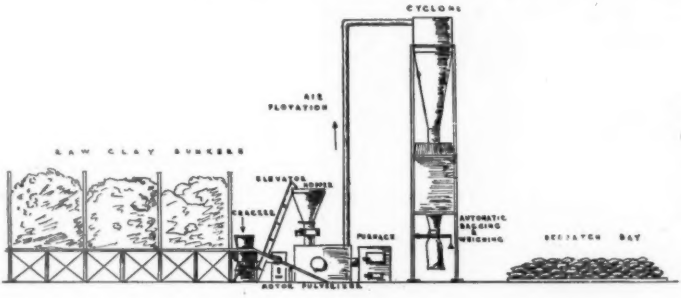


FIG. 2.—SKETCH SHOWING SCHEMATIC LAYOUT OF CRUSHING, DRYING AND PULVERISING PLANT FOR FOUNDRY BONDING CLAY.

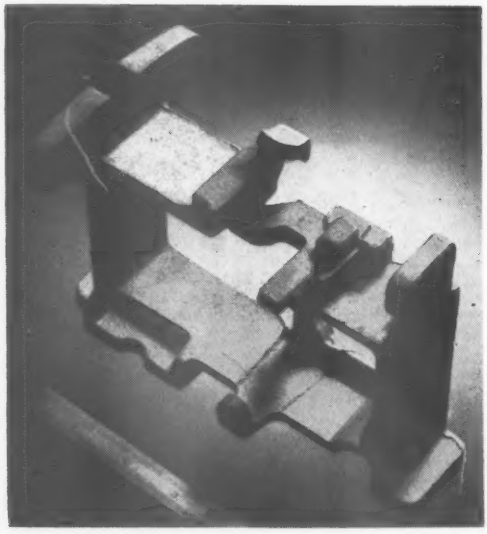


FIG. 3.—FRAME-TYPE IRON CASTING MADE IN SPECIAL CLAY-BONDED SAND; NOTE THE CLEAN STRIP.
(Courtesy Drake Foundry, Limited, Coventry.)

FIG. 4.—TYPICAL STOVE-PLATE CASTING BEFORE AND AFTER VITREOUS ENAMELLING.

foundries of kaolinite clay*, primarily used as a supplemental addition to natural moulding sands. The object of the visit was dual in character, information was sought on the source and processing of the material and on its practical application in foundries, information which, it was thought, would be of major interest to our industry generally, and particularly to those firms contemplating the use of an auxiliary clay in their shops.

Material and Processing

The material handled by this organisation is a Dorset clay of the kaolinite variety—its chemical composition is indicated in Table 1. A view of the actual clay pit is shown in Fig. 1 from which it is clear that the deposit is stratified and that there is considerable overburden. Nevertheless, ample reserves are available for many years to come, uniformity of product being assured by modernised and progressive working methods. According to the strata level, grades of clay

* Marketed under the name "Albond."

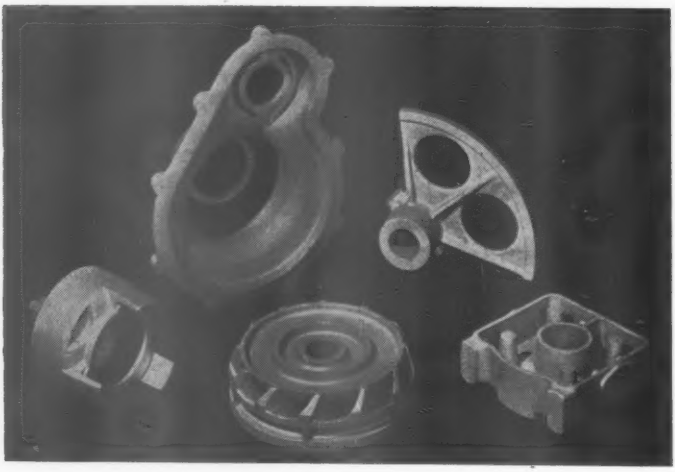


FIG. 5.—GROUP OF BRASS CASTINGS PRODUCED IN SAND WITH SPECIAL CLAY ADDITION.
(Courtesy Sandwell Casting Company.)

TABLE I.—*Typical Composition and Properties of a Foundry Bonding Clay.*

	Per cent.
Free moisture	1.78
Combined moisture	7.12
Loss of ignition (organic matter)	0.47
Silica—free	10.03
Silica—combined	45.07
Alumina	31.03
Ferric oxide	0.91
Lime	0.33
Magnesia	0.61
Titanium oxide	0.55
Copper oxide	Nil
Sulphuric anhydride	0.06
Alkalies as Na_2O	1.83
Undetermined	0.21

Refractoriness Squatting Test.
Cone 29 to Cone 30
1,650 deg. C. to 1,670 deg. C.

vary slightly; that selected for foundry use is greyish-pink in colour, quite easily powdered in a dry summer, but tough and leathery in wet weather. It is delivered to the processing works (at present situated in the Midlands, but later to be de-centralised) in the form of clods, roughly 12 in. long by 4 in. square. After a period under cover for weathering, which serves to spread moisture content more evenly and reduce the over-all amount, the clay is broken up by hand to "first-size" lumps and then fed into a fully mechanised treatment plant. Here, it is blended, dried, crushed, pulverised and metered out into cement-type paper bags, all in one unbroken sequence. The plant is shown roughly sketched in Fig. 2. In the final stages, the clay is air-borne and is within the 300- to 350-mesh fineness range. At essential points, there is adequate dust suppression or exhaust to open air.

FIG. 6.—MALLEABLE CASTING PRODUCED IN SAND, PARTICULARS OF WHICH ARE LISTED IN TABLE II.
(Courtesy John Maddock & Company, Limited.)

Practical Applications

Having witnessed the operation of processing, which, though here simply described, was not without initial "teething" troubles, the writer's attention was turned to practical aspects attending the use of the clay in foundries. For this, a number of technical progress reports and photographs of castings were collected from consumer foundries of various categories, mostly located in the Midlands. This latter fact is significant,

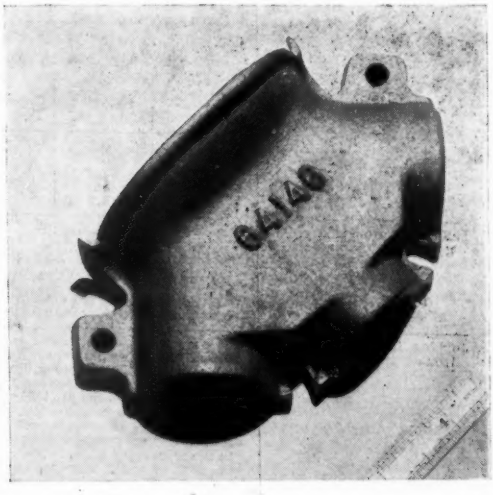


FIG. 7.—IRON CASTINGS FOR THE ELECTRICITY SUPPLY INDUSTRY. EXAMPLES OF NORMAL PRODUCTION FROM BLACK-COUNTRY FOUNDRY.

Sand Mixture:—Black sand, 112 lb.; new red sand, 28 lb.; coal dust, 3 lb.; clay, 1 lb., and water to 5.0 per cent.

Foundry Bonding Clay

because one would normally incline to the view that Midland founders, possessing ample supplies of natural, good-quality, red moulding sand (on their doorsteps, as it were), had little need for clay additions. Be that as it may, the facts disclosed speak for themselves—a major use for the clay is in just such foundries, particularly for use as a general, low-percentage addition.

The castings are shown in Figs. 3, 4, 5, 6, and 7, and the foundry reports in Table II. It is clear from the appearance of the castings that the sand used for them was in good condition. From the figures and reports quoted there is evidence that, for a wide diversity of foundry practice, the addition of this low percentage of clay effects a worthwnile improvement.

Another use for the special clay is for imparting "green" strength to core sands. For this purpose the addition of clay is made in the core sand mixer along with the normal ingredients; washed silica sands are generally used and there is found to be no harmful reduction in final permeability when the clay is added. The new ingredient gives added "hot-strength" for making thick-section castings. For this application, a typical experience is quoted in Table III.

TABLE II.—*Reports from Foundries Using Special Clay Additions to Moulding Sand.*

Description of foundry.	Sand practice.	Remarks.
Large, modern, mass-production iron foundry. Output mainly stove-plate for vitreous enamelling.	Facing sand mixing:— Per cent. Milled red sand .. .. .. 26.4 Black system sand .. .. 70.5 Superfine coal dust .. .. 2.0 Clay (Albond) 1.1	Mixture is typical of that in daily use. A small casting before and after vitreous enamelling is shown in Fig. 4.
Brass foundry producing small and medium-weight castings on a mass-production basis.	The sand used is based on Bromsgrove red and the properties are normally controlled between 8 and 11 lb. per sq.in. green-bond strength and 30 to 40 permeability No. at a moisture content of 5 per cent. Control of properties is gained by alterations in the clay addition, the ratio of fresh sand to knock-out sand remaining approximately constant at three to four per cent. of the daily sand turnover. The mix normally employed to maintain the above properties consists of 15 to 20 per cent. Bromsgrove red sand, 2 to 6 per cent. clay, water as required, balance burned floor sand; coal dust, etc., being added as required for particular jobs. Although the ratio of fresh sand may at first glance appear quite high it must be borne in mind that only a proportion of sand is re-milled.	The maintenance of the desired properties of the foundry moulding sand by the addition of small quantities of clay to the re-milled sand has proved of value from two aspects. First, it has enabled a closer control to be maintained on the properties of the milled sand and any variations required in these properties for particular jobs can be made quickly and accurately. Secondly, it has enabled the additions of fresh sand to be reduced to a level comparable with natural wastage and has thus permitted a substantial reduction in the cost of labour and transport involved in the disposal of surplus sand. As the bulk of castings dealt with in the foundry (see Fig. 5) are of light or medium weight and are moulded green, it is possible roughly to separate the sand at the knock out into two portions, that which has been burned by actual contact with the casting and a relatively unaffected portion of the baking sand, which does not require re-milling but can immediately be re-used as backing sand after cooling and any necessary adjustment of the moisture. Since the burnt portion of the sand represents on an average only about 20 per cent. of the total sand content of the mould, this practice shows very considerable saving in milling capacity over that required to re-mill the whole of the knock-out sand.
Ironfoundry producing bath castings on a mechanised plant. Castings subsequently vitreous enamelled.	Facing sand mixing:— Per cent. Congleton sand .. .. 92.0 to 93.0 G.B. Kordek .. .. 1.0 Coal dust .. .. .. 4.5 to 5.0 Clay .. .. .. 3.0 Green strength (comp.) .. 3.2 lb. per sq. in. Permeability .. .. 160 System sand (4.0 per cent. addition of clay):— Permeability. | Moisture, per cent. | Green strength, lb. per sq. in. 85 | 4.5 | 6.0 83 | 5.0 | 6.0 75 | 5.8 | 5.9 75 | 5.3 | 6.3 70 | 5.2 | 6.4	Figures taken from routine sand-test record book.
Malleable ironfoundry, on general-engineering castings.	General facing sand mixing:— Returned sand .. .. 6 cwt. New loam sand .. .. 10 lb. Coal dust .. .. .. 30 lb. Clay .. .. 8 lb. With moisture at 4.5 per cent. gives green compression strength of 8·0 lb. per sq. in.	For the casting shown in Fig. 6, less than one per cent. special clay was used in the facing sand.
Jobbing foundry on heavy iron castings.	A mechanically-hoisted bucket containing 6 cwt. of previously used sand is loaded and added to this is approx. 5 per cent. pitch and 5 per cent. special clay. This is then taken into the sand mixer where moisture to 4 per cent. approx. is added. After mixing, it is delivered to steel buckets and conveyed by overhead crane to the moulding position. This becomes the backing sand. For the facing sand, the same procedure is followed except that instead of the full 6 cwt. of used sand only approx. 3 cwt. are taken, the remainder being new sand plus pitch, clay and moisture, proportions roughly as previously stated.	Clay additions normally used in both facing and backing sand. The particulars listed relate to the making of a 4-ton casting.

Conclusions

Naturally-bonded sands, as mixed, consist of silica grains coated, with varying degrees of uniformity, by kaolinite or complex (in the case of red sands particularly) hydrated clays. The properties developed on milling this sand are a function of the intrinsic nature of the clay, its spreading power, the size, grading and shape of the sand grains, the moisture content and so on. Only when optimum values of the several variables happen, by chance or arrangement, to coincide, does the resulting sand function well in the foundry moulding box. When, therefore naturally-occurring clay in a sand is destroyed during the casting operation, there is obvious merit and economy in replacing just the amount destroyed by a pure uniform clay of known properties. Indeed, it is postulated that in many foundries, where a de-silting operation or normal waste carry-away effectively disposes of "fines," there is only need of sufficient new sand to be added to the system to replace incidental loss and a small amount of clay to make-up for that "burnt" during casting. Such additions are easily controlled and require a minimum of supervision in both mechanised and non-mechanised plants. That this practice is in fact becoming of increasing importance is amply shown by this investigation.

There is a widespread school of thought which holds that, if clay additions to moulding sands are to be recommended, it is better to go all the way and add a pure clay to a pure silica sand. There would seem to be justification for the heavy expense and fine degree of control necessary for this type of foundry-sand system, when naturally-occurring bonded sands are of poor quality, as in America. Where, however, as in this country, there is an abundancy of supply and variety of qualities to be found with naturally-bonded sands, it seems for ordinary practice to be a retrograde step to insist on the wholly synthetic. The rejuvenating addition of the small proportion of special clay may prove to be the happy medium and the final choice for a long-term policy. For specialised foundry practice and very exacting applications, sands with above-average refractoriness or other outstanding qualities will always be required. These may well be of the more "synthetic" variety with higher percentages of added clay. Similarly, for special core sands requiring high green-strength together with high permeability and non-collapse at high temperature, part clay-bonded mixtures have been proved satisfactory.

TABLE III.—*Use of Special Clay in Core Sand.*

Description of foundry.	Sand practice.	Remarks.
Large general-engineering iron-foundry making castings from 4 oz. to 15 tons.	Oil sand for cores :— 1 cwt. Congleton silica sand 2 pints clay. 5 pints proprietary core oil. Method :—Add to mill in the order quoted and mix for 4 to 5 mins.	Green strength and dry strength are imparted to cores. After baking at 350 deg. C., moisture absorption into the cores is prevented. Any section of metal can be cast around the cores and, despite metal temperatures of the order of 1,450 deg. C., castings strip cleanly.

Book Reviews

Mechanical World Year Book, 1950. Published by Emmott & Company, Limited, 31, King Street West, Manchester, 3. Price 3s. 6d. net.

The reviewer has received the impression, though perhaps quite wrongly, that the Editors have concentrated more and more on tabular matter and reduced to some extent the small specialised articles on each subject, though of course they still exist. From books of this type, he expects fundamental data and he is satisfied that this one ranks amongst the most useful. An important factor in a year book is the index, and the one provided is commendably comprehensive. A thorough revision has been undertaken, without, however, materially altering the well-established make-up.

F.B.I. Register of British Manufacturers, 1949-50. Published for the Federation of British Industries by Iliffe & Sons, Limited, Dorset House, Stamford Street, London, S.E.1. Price 42s., post free.

This is an excellent work of reference as it lists all the members of the Federation, their products, addresses, brands and trade marks. It covers the largest makers of beer, cement, perfumes, machinery—in fact, almost everything one can think of, including that obsolete word "semi-steel." The binding and general presentation are really good and overseas readers will find it useful as a means of locating suppliers of British manufactures. The lists are brought up to date by a loose supplement. This follows the general practice used throughout the book of printing the "sign posts" in three languages.

Denationalisation in Practice. By G. William Neville. Published by the Individualist Bookshop, Limited, 147, Victoria Street, London, S.W.1. Price 2s.

This little book relates numerous cases throughout the world where State monopolies have reverted to private enterprise with the object of avoiding continuous financial losses. Strangely enough, it has omitted the well-known use of the German coal mines, which after the 1914 war were nationalised and later returned to private ownership.

The Electrical Year Book, 1950. Published by Emmott & Company, Limited, 31, King Street West, Manchester, 3. Price 3s. net.

The major revision of the 1950 edition of this extremely useful handbook has been to cater for the welder and the instrument tester. All the well-known and much appreciated features have been retained.

Fuel Efficiency Exhibition

The Fuel Efficiency Exhibition being held at the Stocksbridge works of Samuel Fox & Company, Limited, is the culmination of the year's effort on the part of the fuel-efficiency organisation. This organisation has been developed during the last few years with the basic idea of improving the fuel efficiency of the works through the efforts of all employees, as it is felt that fuel efficiency is the responsibility of all and not of the fuel-engineering department alone. So that the whole of the works can be under constant surveillance, volunteers were asked for, who would become members of the organisation and who would watch during their working hours for any sign of inefficiency and report it. These reports can be made either through an intermediary such as a foreman or manager, a member of the departmental fuel-efficiency committee, or direct to the fuel-efficiency organiser, who is a member of the fuel-engineering department. One in every six employees is a member of the organisation. Every month, a meeting is held in each department to discuss various problems relating to efficiency.

American Specifications for Cast Iron

A Paper by Mr. H. Bornstein given to the first Pacific-area National Meeting of the American Society for Testing Materials on the subject of the Development, Significance and Uses of Specifications for Cast Iron, relates in detail the history of specifications for cast iron in America, and finishes with two sections of importance to those interested in the more recent general applications of the subject. The first of these two sections reads:—

Significance of Specifications

The A.S.T.M. has two general specifications for grey-iron castings. One is the A48-48 and covers those castings (not covered by other existing A.S.T.M. specifications) where strength is a major consideration. The other is A190-47 which covers light-weight and thin-sectioned castings in which appearance, machinability and dimension tolerances are primary considerations. Besides these two general specifications there are a number of specifications covering certain items or products such as the following:—A126-42, grey-iron castings for valves, flanges and pipe fittings; A159-47, automotive grey-iron castings; A44-41, cast-iron pit-cast pipe for water and other liquidis; A74-42, cast-iron soil pipe and fittings; A142-38, cast-iron culvert pipe. The range of specifications is such as to permit the engineer to select a specification which meets his needs. These specifications have been revised from time to time in order better to suit the needs of the user and producer of castings. Necessarily, specifications must follow the progress in an industry, but frequently the development of specifications stimulates such progress. Furthermore, specifications furnish valuable information concerning the material to be supplied. They permit the acceptance or rejection of castings on the basis of meeting definite requirements.

The second section carries the following caption:—

Uses and Abuses of Specifications

Assuming that there are adequate and proper specifications, there is still a job to be done, and it is a most important one. That job is to educate the buyer and seller to the proper use of a specification. An engineer looks at specification A-48 and finds he can obtain castings in various classes in respect to strength, ranging up to 27 tons per sq. in., minimum tensile. He assumes that a class-40 iron is better than a class-30 iron, although the latter iron will give him all the strength required for the part. If the class-40 iron is specified, a mistake has been made because such material is usually most costly and more difficult to machine. If the foundryman knows that the wrong class has been specified he should call it to the attention of his customer. During the past war, there were many cases where higher-strength irons were specified but were not needed. There was an erroneous assumption that if 13 tons per sq. in. tensile was good, then 22 tons must be better. Such a specification resulted in higher costs, lower production and waste of alloying materials. In many cases, it was found necessary to change these specifications, and these changes were made on the basis of experience. The foundryman should work closely with his customer to see that the proper material is specified. In other cases, wearing properties may be the principal item and yet high strength is specified. Frequently, the desired results can be obtained by reducing the strength requirements and specifying the desired structure and hardness range.

Alloying elements have their proper place in cast iron and fulfil a definite need. Alloy cast irons may be required because of wear resistance, strength, machinability or heat treatment. However, there are many cases where alloying elements are specified and are not needed. Here again, the foundryman can perform a distinct service for his customer in pointing out the essential facts. There is a definite trend towards more easily machinable castings and frequently this is accomplished by a suitable heat-treatment. The heat-treatment (stress-relief or annealing results in a lower and more uniform hardness range and better machinability.

Castings do fail in service and it is necessary to determine the cause of failure before a change in specification is made. Usually, the answer does not indicate the use of a higher-strength cast iron. In some cases, it may be that failure has resulted from a high stress concentration, and a slight change in design may be more effective than the use of stronger material. In other cases, unsoundness is the cause, and this should be rectified through improved foundry practice or change in design, or both. Specifications for grey-iron castings serve a definite need in industry and they should be intelligently used to obtain maximum performance with economy.

A Core-oven Fatality

A correspondent has very courteously sent us a newspaper cutting which details the sad death of a labourer through being trapped in a core stove. He submits five suggestions, which read:—

(1) An obvious aid to prevention would be to have a notice placed on each stove door reminding the operator to make sure that there is no one in the stove at the time the door is being closed. More positive action would be:—

(2) An 8-in. dia. hole could be cut through the stove door and a small internal swivel door fitted which could be swung aside in an emergency. It would then be possible for anyone, unfortunate enough to be trapped, to shout or wave an arm through the hole.

(3) If the oven door is structurally suitable, a manhole could be cut and a lid fitted, which could be removed from the inside.

(4) A culvert with removable top plates could be built under the door through which a person could escape.

(5) The existing door-locking arrangements could be made to operate, also, from inside the stove.

The Editor saw a tragedy of a similar character during the 1914 war in Milan, and since that time has repeatedly stated that no accident of that kind could occur in this country owing to our innate factory sense.

Steel Founding

Mr. F. A. Martin has drawn our attention to an ambiguity which is apparent in the last paragraph of the report of his address on Steelfounding printed in the February 16 issue, page 176. The sentence should read:—

Most of us have other persons who are responsible to us. If what is wrong is to be found among them, it is our responsibility. It is for us to take steps to put it right.

The possibility of double meaning being attributed to the sentence printed arose in the transposition of the spoken to the written word.

Institute of British Foundrymen

Lancashire Branch Annual Dinner

Well-attended Social Function at Manchester

About 200 members and guests assembled on the occasion of the annual dinner and dance of the Lancashire branch of the Institute of British Foundrymen, held at the Grand Hotel, Manchester, on February 3, where they were welcomed by the branch-president, Mr. R. Laroux Handley, B.Sc.(Iecn.), A.M.I.E.E., and Mrs. Handley. Among those present were Mr. N. P. Newman, J.P., president of the Institute, and Mrs. Newman, Mr. D. Fleming, senior vice-president of the Lancashire branch, and Mrs. Fleming, Mr. J. J. Sheehan, B.Sc., A.I.C., senior vice-president of the Institute, and Mrs. Sheehan, Mr. Colin Gresty, junior vice-president of the Institute, and Mrs. Gresty, Mr. Tom Makemson, M.B.E., secretary of the Institute of British Foundrymen, Sir Vincent and Lady de Ferranti, Dr. J. G. Pearce, director of the British Cast Iron Research Association, Mr. A. Watson, assistant managing director of the Stanton Ironworks Company, Limited, and Mrs. Watson. Mr. S. Brooks officiated as toast master.

After the loyal toast, Mr. Handley, greeting those present, mentioned that a letter had been received from Mr. Arthur Phillips, a past president of the Lancashire branch, who was at present in South Africa, expressing the hope they would all spend a very pleasant evening together. Mr. J. Hogg, who had recently been made an honorary member of the Institute in recognition of past services, had also sent word regretting his inability to attend, as also had Mr. and Mrs. John Gardom and Mr. and Mrs. Kenneth Marshall, all of whom expressed their good wishes for a successful evening.

"Lancashire Branch"

MR. N. P. NEWMAN, J.P., president of the Institute of British Foundrymen, in proposing the toast of the "Lancashire Branch," said it was scarcely necessary for him to mention that the Lancashire branch was the first one to be formed after the Institute was inaugurated in 1904, and that it had a great tradition to uphold. It had had many well-known and respected national and branch presidents, and it had done quite as much work to secure the welfare of the founding industry as any other branch in the country.

They must not blink at the fact that they were all now passing through a difficult time, and that the future of their industry seemed somewhat obscure. Some of the work the Institute was able to do was only made possible by the aid of grants from the Joint Iron Council. If such grants ceased to be made, then the activities of the Institute would be much curtailed. Personally, he was a fervant individualist, and he was convinced they could only look forward to making further progress if everyone gave of their best to promote the welfare of the industry and wholeheartedly co-operated in bringing about complete success.

MR. R. LAROUX HANDLEY, president of the Lancashire branch, in responding to the toast, said they all knew that Mr. Newman was a very busy man. Not only was he presiding over the Institute, but he was vice-president of the Joint Iron Council, chairman of the Council of Ironfoundry Associations and president of the National Ironfoundry Employers' Federation, in addition to running his own business most efficiently, as they all knew. It was the desire of all members that the branch should retain a position commensurate with its status as the senior branch in the country.

"The Visitors"

MR. D. FLEMING, senior vice-president of the Lancashire branch, in proposing the toast of "The Visitors," first mentioned Sir Vincent de Ferranti and Lady de Ferranti, and said their name was not a strange one to foundrymen. It was associated with a very progressive foundry which had always occupied a place in the very forefront of the industry, because it had been mechanised very early on. It was now being expanded and equipped in the most modern manner possible.

The Institute itself was very well represented. There were present Mr. N. P. Newman, its president, Mr. J. J. Sheehan, the senior vice-president, and Mr. Colin Gresty, the junior vice-president. Also present was Mr. Arthur Watson, of the Stanton Ironworks. The technical bodies had not been forgotten, because Dr. J. G. Pearce was with them. The branch members had also invited other friends of their own, and because of the fact that one did not invite people one did not like, all could be perfectly certain that they were particularly welcome. He would not make further mention of the ladies, because they were so important that they were having a toast to themselves, which would be proposed by their old friend Mr. Tom Makemson.

MR. J. J. SHEEHAN, B.Sc., A.I.C., senior vice-president of the Institute, said that the visitors had a very keen consciousness—at any rate he had—of the kindly hospitality they had received, particularly so after a very nice dinner. They had received a warmth of welcome which was typical of Lancashire, all of whose people loved "a do" or a party. After generations of practice, Lancashire had become perfect in the art of entertaining its guests.

He understood that Lancashire people were noted for hard hats and mackintoshes. As a matter of fact, the hard hat seemed to be necessary as a badge of respectability, but the mackintoshes did seem to indicate a lamentable lack of confidence in climatic conditions. His friend Tom Makemson had assured him they had very little rain in Manchester, but he could state, on oath if necessary, that for the last seven times he had visited the city there was rain, except upon one occasion when there was snow! Someone had remarked to him that Manchester had not a climate at all; all they had got was a divvle of a lot of weather. They had all thoroughly enjoyed the hospitality which had been accorded them, and entertained a lively hope that the invitations would be renewed upon some future occasion.

"The Ladies"

MR. TOM MAKEMSON, M.B.E., secretary of the Institue of British Foundrymen, in proposing the toast of "The Ladies," remarked that all those who had listened very carefully to the speech of the president of the Institue, would doubtless have formed some shadow of a suspicion that he (Mr. Makemson) was probably a bachelor. He reminded his hearers that the Lancashire branch was the first to arrange for ladies to join the

Lancashire Branch Annual Dinner

members at their annual functions. This was a really true exemplification of the old saying that what Lancashire does to-day, all the other branches start to do afterwards.

Association with other foundrymen was one of the most useful ways of improving technique. The ladies played a very important part in regard to their social activities; therefore, all their menfolk desired to say how much they appreciated the interest showed by them in the work of the Institute. They wanted to thank them for all the encouragement they had received from them, and many a man was thankful for the inspiration he had received from his wife. The toast was coupled with the name of Mrs. Handley.

MRS. R. LAROUX HANDLEY, responding to the toast, said she was sure that all the ladies, like herself, appreciated very much the efforts which had been made on their behalf to ensure that this should be a most happy and pleasant event. The work put in by the social committee and their hard-working secretary, Mr. Yeoman, was, they might be sure, appreciated by all.

MR. S. BROOKS then proposed that a very hearty vote of thanks be accorded to the honorary secretary of the Lancashire branch, Mr. R. Yeoman, for the admirable manner in which he had made the arrangements for the evening, and also to Mrs. Yeoman for her attendance and assistance.

"Wearing Respirators Should be Compulsory"

A proposal for an amendment to the Factory Acts, making it a punishable offence for a man working in certain conditions to neglect to wear a dust mask (which by law must be made available to him) was made by the Manchester City Coroner (Mr. Jessel Rycroft) at the inquest, on February 23, on a man whose death was due to silicosis. The Coroner had investigated the case of Arthur Kirk, an iron dresser employed for about 30 years at the locomotive works, Gorton, Manchester, now controlled by British Railways.

Charles Hale, foundry foreman at the locomotive works, told the Coroner that some men were reluctant to wear the respirators during shot blasting, although they knew they were provided for their safety and welfare. In future, notices would be displayed emphasising the importance of wearing the respirators. The Coroner said it did not appear that the men were legally obliged to wear the masks even if it were compulsory for their employers to make them available, and in view of the evidence in that case, he advised the authorities to consider taking appropriate action.

MR. S. W. B. FLAVEL, B.Sc., has resigned from the board of Sidney Flavel & Company, Limited, iron-founders, of Leamington, with effect from February 15, and has terminated his employment with the company.

The death occurred on February 16 of MR. E. H. COTTLE, who had been foundry superintendent at Tangyes Foundry, Cornwall Works, Smethwick, since 1930. He was a prominent foundryman and was since 1930 a member of the Institute of British Foundrymen.

MR. W. W. HACKETT, J.P., the well-known industrialist and founder of the Oldbury firm of Accles & Pollock, Limited, tube manufacturers, has been presented with a silver cigarette box by his fellow justices at Oldbury, on retiring from the Bench at the age of 75, after 30 years' service.

Condensation Causes Scabbing

By "Coroner"

Scabbing of moulds and cores accounts for a large number of wasters in the foundry and usually the cause is fairly obvious and a remedy can easily be applied. Scabs are usually associated with large flat surfaces rather than curved faces and surprise was shown when a number of crankcase castings were scrapped due to a scab on the bearing core. The core is illustrated at *A*, Fig. 1, the defect being at *B*. The casting was made in the position shown, and the metal was poured along the crankcase face. Cores, *C*, were used to form the interior of the casting.

One cause of scabbing with a core such as that shown at *A* would be if it were insufficiently dry. Moisture, evolved as steam, when trying to escape.

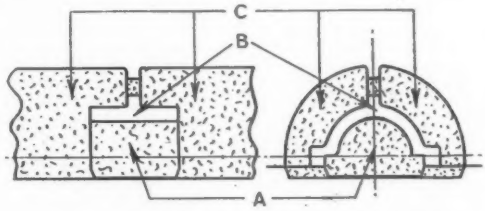


FIG. 1.—SCABBING DUE TO CONDENSATION CAUSED BY ASSEMBLING COLD CORES IN HOT MOULDS.

would cause the top face to lift off. This, however, was not considered the cause of the trouble in this instance, as this particular core was assembled in the mould and dried *in situ*.

After much investigation, it was found that the real cause was a simple one. The castings were usually poured early in the cast and consequently the moulds had to be finally cored up and assembled as soon as possible. Thus, the mould was withdrawn from the stove while hot, the cores, *C*, being immediately placed in position. These latter were invariably cold when assembled and consequently the heat of the mould caused them to steam, especially if much time was allowed for standing before pouring. The condensated moisture from this steam collected on top of the bearing cores, *A*, creating conditions which led to scabbing.

The solution having been found, wasters from this cause were eliminated by ensuring that only hot cores were assembled in hot moulds, or alternatively cold cores in cold moulds. If, for any unforeseen contingency, cold cores have to be assembled in hot moulds the top part is tried in position, the runners and risers are made up and then the whole is lifted off again until just prior to casting. In this way there is no time for condensation to take place and cause trouble.

BRUSH ELECTRICAL ENGINEERING COMPANY, LIMITED, of Loughborough, have decided to form an association of former Brush apprentices. A provisional committee has been formed with Mr. J. H. R. Nixon, technical director, as chairman. An annual general meeting will be held in London later in the year followed by a dinner. All former "Brush" apprentices are invited to write to Mr. K. H. Platt, chief Education Officer, Brush Electrical Engineering Company, Limited, Loughborough, Leicestershire, giving their name, present firm, position held, present address and the date when they were apprentices.

Gas-appliance Users' Demands from the Enameller*

Quality Requirements of the Ultimate Customer

By E. W. B. Dunning, B.Sc., A.R.I.C., M.Inst.GasE.

Introduction

Although the gas-appliance maker may be the buyer of enamel frit and plant, the ultimate user of the vitreous enamel is the housewife. It is obviously impossible for her to explain her requirements in person to the enameller, always supposing that she had a clear idea of what these requirements were. The gas undertaking can, however, take note of her suggestions and observe her use of gas appliances. The gas company is in close touch with its 1¼ million users, and this Paper is based on the results of laboratory tests closely linked with this field experience.

Vitreous enamel is the most usual finish applied to domestic gas appliances, as it most readily satisfies the user's requirement of an easily-cleaned surface, which is heat-resisting. The normal glossy surface is required for kitchen and bathroom equipment, but an easily-cleaned matt surface would have decorative appeal for space-heating appliances. Corrosion-resistant surfaces are required for the flueways of gas appliances and the interior of flue equipment, although the user is not conscious of this requirement.

In these days when comparisons with pre-war conditions are so often unfavourable, it is interesting to note that enamel quality has greatly improved in all its properties, although, naturally, this Paper emphasises the faults which still exist. Neither the housewife nor the gas undertaking distinguishes between faults due to the enamel itself and those due to poor design of appliances or defective cast iron or steel. These remarks are therefore concerned with the complete enamelled article. Although the Author has tried to cover all types of gas appliances, most of his experience is with cooking equipment.

Types of Defects

Enamel defects can be divided into two main groups. Those which are present before the appliance is accepted by the user and those which occur in use. The gas company has drawn up a code of rules for the acceptance of vitreous-enamel finishes.† If no code is used there is a tendency for the supplier gradually to allow more and more flaws until the gas undertaking, becoming aware of the state of affairs by reason of complaints from the user, suddenly rejects almost everything and demands an almost-impossibly-high standard. Some discretion is, of course, necessary, as it is possible to accept more small defects in a mottled finish on a cheap appliance than on a self-colour high-grade job. Defects which may develop later in use cannot be detected by visual observation of the user at the time of purchase. The test methods described in B.S.1344 have been devised to assess the wearing qualities of the enamel. Observations are made later of experience with those tests and the correlation of results with field experience of defects.

Immediate Defects

Visible defects may be present immediately the enamelled article is removed from the firing furnace and these, although the easiest for the manufacturer to detect, are sometimes difficult to prevent, although the sooner they are noticed and the piece rejected the better. The cost of rejecting an unassembled part is only a fraction of the cost of replacing a part in the user's home, which carries with it consequent loss of consumer's satisfaction. The more important of these visible defects are as follows:—

(*a*) *No Enamel.*—This most commonly occurs where the ground coat is exposed (*e.g.*, wiped edges and interiors of flue pipes) and on subsequent firing of the cover coats this exposed ground coat is destroyed. Blisters, pinholes and perrett marks come into the same category. All lead to a rusting and finally the destruction of the base metal.

(*b*) *Small Surface Defects.*—Specks, dimples, lumps, "run down," "fish scaling," "copper heads," etc., are well known to the enameller, and much has been written in technical literature on the causes and prevention of this type of defect. The Author feels that sometimes too much attention is given to avoiding minor blemishes. Much usable enamel ware is scrapped, ultimately at the user's cost, and much is given an extra coat of enamel with a consequently greater risk of chipping.

(*c*) *Marking.*—There is a tradition that castings have to be marked to assist identification. When these castings are enamelled, raised letters may not be completely covered with enamel; generally all letters if covered with enamel cannot be read distinctly, and, more important, form grease and dirt traps in a supposedly "easy-clean" surface. Sheet-steel parts are seldom marked, as it is a difficult operation, and yet they seem to offer no more difficulty in identification. Where parts must be marked to instruct the user or give the maker's name could not a simple transfer or stencil be used? It is said that this means an extra firing, but perhaps some ingenious enameller could get over this difficulty.

*Paper presented to the 13th Annual Meeting of the Institute of Vitreous Enamellers.

†See Appendix.

Gas-appliance Users and the Enameller

(*d*) *Wiped Edges.*—The wiping of the cover coat from sharp bends, edges and screw holes greatly minimises chipping. Care must however be taken to avoid a "mourning-card" effect. The ideal is to wipe the edges so that they pass unnoticed by the housewife.

(*e*) *Colour Matching.*—The housewife is definitely interested in coloured enamels and the standardisation of a limited range of colours as given in B.S.1358 should do much to enable her to obtain attractive colour schemes. Castings and pressings give different shades with the same enamel and adjustments must be made to obtain machining. Mottled enamels are more difficult to match, as so much depends on the operator. The Author has found the most satisfactory method of checking is to have two enamelled plaques, one the lightest permissible and the other the darkest. If the two plaques are mounted on a black ground with a hole between, through which the test sample can be viewed, it is easy to decide visually if the enamel under test comes within the two limits.

Colours are often regarded by the manufacturers as a luxury finish, and flawless finishes are produced at high cost, although the actual extra cost of the enamel frit may be negligible. Lower costs with slight imperfections perhaps hidden by coloured mottling might be more acceptable to the bulk of consumers. The colours given in B.S.1358 appear adequate, but it would be advantageous if the standard British Colour Council names were included. Sales literature gives colours of appliances by name, the user buying an apple-green-coloured cooker from the gas showroom expects to obtain a reasonable match when she visits the ironmonger to buy apple-green saucepans

Thin coatings have many advantages, but these must not be obtained at the expense of opacity. The user does not like to see the ground coat showing through the cover coat, even if the enamel is less likely to chip. Gloss is also important to the user, although not as yet covered by a specification.

Transport Defects

These occur after the appliance has been passed by the manufacturers' inspectors and before final acceptance by the user. By far the most important defect is chipping. The factors concerned are:—

(a) *Enamel Quality.*—Although adherence plays a part, thickness of enamel is probably the main consideration. A thick enamel coat probably resists the crushing action of a blow better than a thin coat, but if the blow results in deformation of the underlying metal, then the thinner coat will take the resulting strain better. Thus impact-testing machines which hold the enamel rigid show better results with thicker enamels. Recent American results suggest that reduction in thickness of enamel greatly reduces chipping in transport. A single cover-coat over the "grip" finish is now possible in this country, with an overall thickness of 0.01 in. The use of high-titanium steel enables the grip coat to be dispensed with, and may reduce the overall thickness to less than 0.005 in., *i.e.*, the thickness of organic finishes. This steel is being used experimentally in America. There is little doubt that a thick-gauge base metal results in less chipping than a thin one. Comparisons between enamelled cast iron and sheet iron always assume that the sheet iron must be thin, though present plant is capable of turning out heavy-gauge pressings of excellent rigidity and without the irregular thickness of cast iron.

TABLE I.—*Application of Tests to Enamelled Ware.*

Test.	Applicability.	Articles to be tested.
Citric-acid test	All parts on which foods might be spilt.	Cornice, hot-plate section, crown tray, grill pan, oven lining, refrigerator lining, top of radiator.
Sulphuric-acid test	All parts which come into contact with products of combustion.	Interior of flue pipe, radiator, etc., hot-plate pan-support, oven lining, grill cover.
Alkali	Parts on which grease may bake, necessitating cleaning with caustic-soda jelly or soda.	Oven lining, hot-plate pan-support.
Abrasion ..	All parts which may be cleaned with gritty cleaning powder or subjected to constant rubbing.	Almost all parts accessible to the user.
Thermal shock	Parts subject to alternate heating and sudden cooling by water.	Crown tray, grill pan, pan support, oven lining.
Heat resistance	Parts subject to temperatures above 400 deg.F.	Oven lining, pan support, grill cover, coke grate and boiler, radiant panel.

Speck.	Maximum distance at which it is readily visible.	Approximate size (inches).
Small	Up to 3 ft.	1/100 to 1/64
Medium.. ..	Up to 6 ft.	1/64 to 3/64
Large	Over 6 ft.	Over 3/64.

(b) *Design.*—Enamelled parts should not be used as load-bearing structures; they are normally hung on a framework. Soft washers should be used under all screw-heads. The use of large shaped pieces without joints reduces the number of sharp bends and the bolting of enamelled surfaces together. One-piece enamelled oven linings may be more costly to replace if chipped compared with separate parts, but the liability to chipping may be greatly reduced in the former case.

(c) *Packing.*—A balance must be held between cost of packing and cost of damage. Elaborate crates or fabric covers have to be returned for re-use if the cost is to be kept reasonable, and this presents difficulty. Non-returnable packing has advantages, but has to be skilfully planned if the maximum protection is to be given with the minimum material. Many manufacturers take their prototype appliances "for a ride" and find that modifications to the appliance or packing suggested by this practical experience greatly reduce subsequent damage in transit on normal despatches.

(d) *Care in Transport.*—In general, road transport leads to less damage than rail, as, with the later, shocks are set-up due to mixed freight. There is little damage in transport between showroom and consumer, as specially-designed low-loading vans, with two or three exits, are used. Little thought has been given to the ultimate stage, when a carman has to carry the appliance, generally a cooker, up a flight or so of stairs and where often he has little on which to get a firm hold.

Defects which Occur in Use

Up to the stage when the appliance is put into service, the manufacturer has control of the appliance, and can determine with some precision the reason for a defect occurring. In use, the appliance may or may not be given reasonable treatment; if, however, numbers of

FIG. 1.—ABRASION, ACID-RESISTANCE AND THERMAL-SHOCK TESTS IN PROGRESS.

the same defect are reported from different users, then it is probable that the usage is normal and some action is required to obviate the cause of the defect. In the gas company's system. all defects are recorded and tabulated so as to give this numerical significance to the various types of defects. The majority of users do not, however, report defects when they occur; they either accept them as inevitable and class them as normal wear and tear, or they do not trouble to complain, while registering a resolve to avoid the brand on future occasions or in recommendations to friends.

Laboratory tests are made, Fig. 1, in accordance with B.S.1344 on samples of new appliances with the object of reducing the defects which occur in use. All these tests are not indiscriminately carried out on all parts. Tests are chosen in relation to service requirements. Table II attached gives the results of a large number of tests to B.S.1344 on many items of enamelled cooker parts.

Life tests are also carried out in the laboratory. The appliance is arranged so that the gas is turned on and off automatically day and night and a few months' test may be equivalent to many years field use. These tests, wh le valuable, do not exactly reproduce field conditions. They are supplemented by "home tests" in which appliances are installed in employees' homes and operated under normal conditions. Questionnaires are prepared by the laboratories and reports are furnished every six months as to the functioning of the appliances. As a result of this laboratory and field experience, the following observations can be made on the principal types of defect which occur in use:—

Mechanical Chipping.—Once the appliance is installed, the greatest danger of mechanical chipping of the main structure is pased. Chipping is then mostly confined to loose parts, such as grill pans and crown trays which may accidentally be dropped. As mentioned earlier, increase in gauge of the supporting metal is probably the main method of reducing this defect. When the base metal is severely deformed, even the thinnest enamel coat will not stand the resultant strain. The loose parts can, however, be replaced more cheaply than the fixed parts, as, with the latter, work has to be done on the premises by a fitter. As yet, no suitable test for chipping has been evolved although the thermal-shock test may be a good guide.

Thermal Shock.—Crazing and subsequent chipping due to intermittent heating and cooling occur particularly on grill pans and crown trays, because they get heated and then are quenched by liquids spilling on them. A warning notice on the crown tray instructing the user to keep the grill pan in position under the

TABLE II.—*Results of a Large Number of Tests on Enamelled Cooker Parts.*

	Acid.					Alkali.			Abrasion (Fails at Mohr's scale.)					Thermal shock.		Heat resistance.	
	Citric acid.			Sulphuric acid. (Reduction compared with citric-acid test.)													
	Pass.	Near Pass.	Fail.	Pass > Near Pass	Near Pass > Fail	Pass.	Near Pass.	Fail.	> 5.	6.	7.	8.	9.	Pass.	Fail.	Pass.	Fail.
Crown trays ..	26	6	11	4	1	21		1		2	6	14	14	15	35	—	—
Grill pans ..	7	2	12	—	—	9	1	1		2	6	5	8	7	20	—	—
Oven linings ..	33	1	7	6	1	37		0			6	15	18	17	6	13	2
Bars	32	10	10	6	5	21		3	8	14	13	6	4	28	17	41	4
Miscellaneous ..	17	4	29	3	3	15		2		6	9	13	17	6	12	10	1
Total ..	115	23	69	19	10	103	1	7	8	24	40	53	61	73	90	64	7
Percentage	56	11	33			93	1	6	17		22		61	45	55	90	10

FIG. 2.—CROWN TRAY HEATED TO 190 DEG. C. AND SUBJECTED TO IMPINGEMENT OF A STREAM OF WATER AT 15 DEG. C.

grill when it is alight can only shift the crazing from one part to another and during the grilling process the pan must be removed for loading and inspection. Attention to the coefficients of expansion of enamel and the underlying metal and reduction in thickness of the coating can do much to minimise this defect.

The thermal-shock test is the most time-consuming (90 min.) and, normally, the results are not very consistent. More uniform results are obtained by controlling the cooling water at 15 deg. C. and arranging the radiant-heating surface so that a test-piece of enamel just reaches 190 deg. C. ± 5 deg. C. at the end of ten minutes (see Figs. 2 and 3). Of those taken, nearly three-quarters of the crown trays and grill pans failed to pass this test, while only a third of the hot-plate bars and oven-linings failed. It has been suggested that the test is too severe and that enamel will only pass this test if it fails to pass the acid test. Of a group of 115 parts tested, 54 per cent. passed both the acid and thermal-shock test, 36 per cent. passed the acid test only and only 10 per cent. passed the thermal-shock and yet failed on the acid test. It is also interesting to note that the crazing of crown trays and grill pans in use was in the past very prevalent, but much more resistant enamels are now being offered.

Heat Resistance.—Burning of the enamel, no matter how severe the heat applied, is a cause of disappointment to the user. Much has been done to produce enamels more resistant to heat, but, if the temperature of using approaches the original firing temperature, changes are bound to occur. The solution is largely one of careful design so as to keep the temperature of enamelled surfaces below the critical temperature. Coke grates have been insulated by firebrick, the doors of domestic coke boilers protected by iron plates and burner ports on cookers arranged to avoid flame impingement. Asbestos mats are sometimes used to give even distribution of heat in the preparation of jam, etc.; they lead to higher temperatures of the hot-plate bars. Grill covers are also subjected to high temperatures. Enamelled radiant panels have also crazed badly in use, but a more resistant type of enamel is now being used. Oven linings sometimes craze due to overheating and then flake. This is generally due to the design of the oven. Modifications to the oven gates of one cooker led to a reduction in side-lining temperature from 260 deg. to 150 deg. C. and, as a result, defective items from this cause have been reduced to negligible proportions.

The heat-resistance test, Fig. 4, is specified for cast iron only, although the same test may be used on sheet iron if the part concerned has to withstand this condition (*e.g.*, a pressed-steel grill cover), 90 per cent. of all parts tested have passed this test. An examination of hot-plate bars in use shows that temperatures of 450 to 500 deg. C. can be obtained on the pan supports under certain conditions and, if an asbestos mat is used, temperatures of 500 to 600 deg. C. may be reached. It is suggested that the test temperature should be raised from 400 to 500 deg. C. Probably the majority of parts then will still pass this test.

Staining.—The standard acid-resistance test (Fig. 5) can be easily applied and gives consistent results. A failure gives a well-defined etched surface and there is little need to rub in any colloidal graphite as recommended. Some enamels show a mark when viewed at some angles, although the gloss still remains. These are

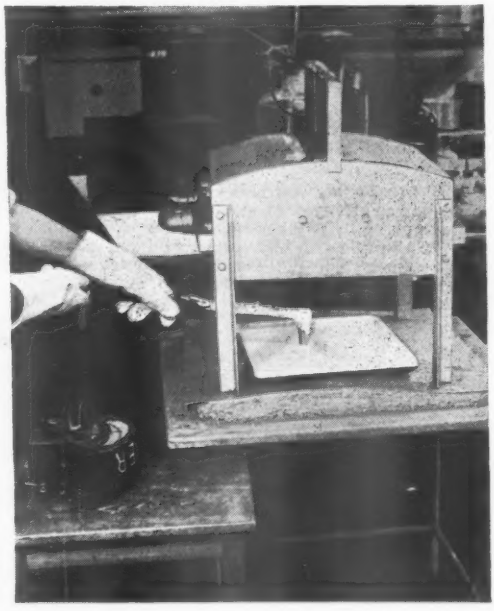


FIG. 3.—CROWN TRAY BEING HEATED TO 190 DEG. C. IN 10 MIN.

FIG. 4.—HOT-PLATE BAR BEING HEATED TO 400 DEG. C. IN 15 MIN., SHOWING THE USE OF A SURFACE PYROMETER.

classed as "near pass." Two-thirds of all enamelled ware tested passed the test. If the "miscellaneous" section given in Table II, comprising parts which are not normally specified as acid resisting, is ignored, then three-quarters are satisfactory. The sulphuric-acid test gives similar results, but is a little more severe.

The alkali test (Fig. 6) gives consistent results, but takes more time. In general, all enamels are alkali resistant; only 6 per cent. failed to pass the test. The test is normally carried out with 5 per cent. sodium-carbonate solution, but parallel tests using 10 per cent. caustic soda surprisingly gave similar results. A simpler test with caustic-soda jelly, on the lines of the acid test, appears worth investigating.

Enamels that are acid- and alkali-resistant to British Standard tests are not likely to be attacked by any of the ordinary materials found in the kitchen. In this sense, the enamel can then be said to be "stainless." There is, however, another form of staining which is the cause of complaint, although the enamel quality has little to do with it. This is the burning on of spillage, etc., which the user then has difficulty in removing. This is often reported as defective enamel, although it can be demonstrated that the enamel is quite intact under the layer of deposit. The user has been led to believe that vitreous enamel is an easily-cleaned surface, so this is, to him, a defect of the enamel. Experiments reported elsewhere have shown that the deposit—to quote from the report—"becomes increasingly difficult to clean as the temperature increases from 200 to 270 deg. C., and there was a marked difference in ease of cleaning for even a 25-deg. C. rise in temperature. At higher temperatures than 270 deg. C. the grease tended to burn off and the cleaning became less difficult. It thus seems clear that surfaces should either be kept as cool as possible (below 200 deg. C.) or allowed to become so hot that the grease burns off." Tests with different materials have shown that stainless steel is the easiest to clean, closely followed by vitreous enamel. There appears to be little difference in this respect between self-colour and sponge- or spray-mottle enamel finishes. The most usual part to give rise to complaint is the hot-plate pan support, especially if it is of webbed construction to hide the burners underneath. Loose trivets reduce the temperature of the hotplate and so aid cleaning. The trivets themselves get hotter and may reach the burning-off stage. However, these can be more easily cleaned at the sink than the whole hotplate.

FIG. 5.—HOT-PLATE BAR UNDER CITRIC- AND SULPHURIC-ACID TEST. GRILL PAN IN THE BACKGROUND FAILED UNDER TEST.

FIG. 6.—OVEN BASE-PLATE SUBJECTED TO FIVE PER CENT. SODIUM-CARBONATE SOLUTION AT 80 DEG. C. FOR 20 MIN.

The shape of the appliance can also aid cleaning; rounded corners and larger pressings are advantageous. Light colours show up the spillage, which is thus more likely to be wiped off. "Little and often" applies particularly to the cleaning of enamelled surfaces. If spillage collects on a part which cannot readily be wiped, it is likely to accumulate and be difficult to remove. Staining can also result from rusting of metal which has not been completely coated with enamel. "Bloom" of the enamel used to occur, but seems to have disappeared completely now that more acid-resistant enamels are used.

Wear

The abrasion-resistance test, Fig. 7, gives consistent results. Crown trays and oven linings are normally not scratched until 8-9 on Mohr's scale, while hotplate bars are softer, scratching at 5-7 Mohr scale. The test itself does not seem to be sufficiently severe. A little powdered Mohr-5 material under a grill pan will scratch a crown tray that is resistant to Mohr 8 using the standard test. It appears that the load of 2 lb. per sq. in. is not as high as that found in practice.

Conclusions

While, in general, the quality of vitreous enamel is high, there is still room for improvement. The appliance manufacturer could do much by specifying that the enamel should satisfy British Standard specification 1344 and then carry out the simple tests here described to ensure that the standard is being maintained. The heat-resistance and abrasion tests should be reviewed and made more severe, as enamels which pass these tests do not necessarily stand up to normal field use. It has been shown that many of the defects reported are not due to the enamel *per se*, but to incorrect design of the appliance.

Present developments to obtain thinner enamel coatings of high capacity should do much to reduce defects

FIG. 7.—OVEN DOOR BEING SUBJECTED TO THE SCRATCHING TEST.

due to chipping in transport and to improve the thermal shock.

Thanks are due to colleagues for their helpful advice, to Mr. B. Carter, who arranged a display of enamels and methods of test, and to the Gas Authority for permission to publish this Paper.

APPENDIX

Code of Rules for Acceptance or Rejection of Vitreous-enamel Finishes

(1) *General.*—The object of compilating these rules was to formulate a basis on which disputes on the question of quality could be discussed and settled. It was hoped that manufacturers would co-operate by submitting suggestions from time to time. Difficulties of formulating and using these rules are realised, and it is expected that they will be applied with some discretion.

(2) *Discoloration.*—A slight blue coloration of the article caused by grip coat or casting showing through the top coat is not cause for rejection, unless the defective area is larger than three sq. in.

(3) *Wiping of Edges.*—Edges shall be wiped free from runs and tears. There shall be a complete covering of enamel along all edges and spots of bare metal will not be permissible. Brown spots do not necessarily indicate that bare metal is exposed. Positive scale spots will be cause for rejection.

(4) *Crazing.*—Crazing or fine hair-like cracks in the enamelled surface will not be permissible. Crazing, covered by a later coat of enamel, is not necessarily cause for rejection.

(5) *Hair Lines.*—Thin blue hair-like lines of grip coat showing through the top coat with no break or crack in the enamel shall be permissible providing that:—(*a*) They are not more than 1 in. long; (*b*) there are not more than two present per surface, and (*c*) there is not more than one present within a 4-in. dia. circle.

(6) *Chipping.*—Surfaces on which the enamel has peeled or flaked off will not be accepted, excepting small unimportant areas on unexposed surfaces.

(7) *Dimples.*—Smooth, well-covered depressions in the enamelled surface will be permissible, providing that no depression is larger than ¼-in. dia., that there are not more than two depressions on any surface and that they are not less than 4 in. apart.

(8) *Lumps.*—Raised areas in the enamel, which are approximately round, will be permissible providing that no lump is more than ¼-in. dia., that there are not more than two lumps on any surface, and that they are not less than 4 in. apart.

(9) *Run-down.*—Sagging enamel, showing as a ridge, or a run resembling a short tear-drop, will be permissible, providing there is not more than one per surface. If the colour contrast is not particularly noticeable, the length of the run-down shall not be more than one in., but if the colour contrast is noticeable, the length of the run-down shall not be more than ½ in.

(10) *Dimples, Lumps or Run-down.*—Dimples, lumps and run-down will be permissible as stated in clauses 7, 8 and 9, but not more than two sorts of these faults shall occur within a 4-in. circle, not more than three sorts on any surface.

(11) *Pin-holes.*—Holes in the enamelled surface, however small, which extend through to the base metal will not be permissible.

(12) *Blisters or Gas Bubbles.*—No lump caused by gases in the base metal being given off during application of the enamel will be permissible if the gas bubble breaks on being pressed with a pin point held in the fingers.

(13) *Specks.*—Dark specks showing through the enamelled surface will be permissible providing that:—(*a*) There are not more than four of medium size and the remainder are small; (*b*) there are not more than eight specks in a 4-in. circle; (*c*) there is not more than one cluster of specks in 2 sq. ft. of surface area, and (*d*) there are not more than 12 specks per sq. ft.

The method of determining the size of specks is shown below:—

(14) *"Waviness" or "Orange-peel."*—A slightly uneven surface of enamel giving a rippled or mottled effect to indirect light is difficult to avoid. Unless very noticeable in direct light, it is not cause for rejection.

(15) *Thick Enamel.*—Not more than one grip and three enamel coats will be permissible for sheet metal or three enamel coats for cast iron. The third coat, if required, shall be kept as thin as practicable, especially in corners.

(16) *Makers' Identification and Other Marks.*—When raised lettering is used for identification, the letters shall be shallow and well-rounded so as to avoid the casting showing through the top coat.

(17) *Packing.*—Enamelled goods shall be packed so as to prevent damage in handling and transport. Instruction labels as to method of handling are desirable.

(18) *Damage in Transport.*—The enamelled surfaces shall be free from cracks, chips, scratches or stains arising after production and in transport.

House Organs

Nickel Bulletin, Volume 23, Number 2. Published by the Mond Nickel Company, Limited, Sunderland House, Curzon Street, London, W.1.

This issue contains a short article on nickel-clad steel in the beet-sugar industry. In describing the refining process of Cocksedge & Company, Limited. of Ipswich. the article touches on the need for heavy-gauge material in the construction of diffusers and gives reasons for the choice of nickel-clad steel for this purpose. Mild steel. previously used, proved unsatisfactory on account of the severe pitting caused by excessive corrosion. By using the nickel to resist the attack of the corrosive medium and the steel to carry the bulk of the stress, nickel-clad steel offers a relatively low-cost material for the construction of heavy equipment of this type. As usual, the bulletin also includes abstracts dealing with other nickel-containing materials. Copies of this publication may be obtained, free of charge, on application to Sunderland House.

The Journal of the Bush Group, Feb., 1950. Issued from 32, Duke Street. St. James's. London, S.W.1.

This is, it is thought, the first time a copy of this house organ has been sent in for review, and it is noticed that it has to cater for a group of widely separated works. This makes the presentation of news very difficult for the Editor, and happenings at one establishment are not of much interest to the others. Thus, wisely, the earlier part of the magazine is of general interest. The reviewer especially likes the story of the detention of Mr. A. C. Geddes, managing director of Associated British Oil Engines in "Transylvania" owing to passport trouble, because he too has suffered similarly. A phrase which he cordially dislikes was one used in connection with a boxed-in notice captioned "Your Vote," which reads:—"... whether we're the general manager or the foundryman." The reviewer is proud to classify himself in the latter category.

News in Brief

GUEST, KEEN & NETTLEFOLDS, LIMITED, East Moors, Cardiff, propose to rebuild Ivor Works Foundry, Merthyr Tydfil, at an estimated cost of £100,000.

A REPRESENTATIVE of William Jessop & Sons, Limited, Sheffield, has gone by air to Belgrade to endeavour to arrange contracts for heat-resisting steel of the type evolved by the firm for use in jet engines. The Anglo-Yugoslav trade agreements have inspired the enterprise, which has received encouragement from the Yugoslav Embassy in London.

BELIEVED TO BE the biggest in the world, a huge steel casting ladle was despatched by road on February 21 from the Teesdale Ironworks of Head, Wrightson & Company, Limited, to the Abbey Works of the Steel Company of Wales, Limited. With a designed capacity of 200 tons and a total weight of 50 tons, it is one of an order of 14 for the company. It was drawn by a 240-h.p. tractor on a 16-wheel trailer.

ANNOUNCING A RECORD OUTPUT of steel plates at the West Hartlepool works of the South Durham Steel & Iron Company, Limited, during the five weeks ended February 11, Mr. Chetwynd Talbot, deputy chairman and managing director, comments that "the achievements of private enterprise have been clearly demonstrated." He visualises a still greater expansion when the development scheme is completed.

JOSEPH SANKEY & SONS, LIMITED, Bilston (Staffs), are to form an Australian subsidiary with a proposed authorised capital of £A.250,000 at Newcastle, N.S.W. Premises are to be acquired from the associated company of John Lysaght, Limited, for the manufacture of electrical laminations and stampings for electric motors, dynamos, and radios. Other lines may be developed later. Production is expected to begin in June.

ACCORDING TO the Tyne Shipbuilders' Association, between September 1 and the middle of December last year 98,500 man-hours (in respect of manual workers) were lost through power cuts in the Tyne, Blyth, Tees, and Hartlepools areas. In addition, 144,000 hours were lost by engineering firms, making a total of 242,500 hours lost. Reckoning this at 2s. 9d. an hour, the Association states, the cost of electricity cuts to shipbuilding and engineering was £33,343.

MANY INDUSTRIAL CONCERNS are installing emergency lighting equipment to supply secondary circuits in the event of heavy load-shedding. Chloride Batteries, Limited, Clifton Junction, near Manchester, manufacturers of the Keepalite emergency lighting equipment, have installed this system at the factory of the Dunlop Rubber Company, Limited, Birmingham, the Shell Refining Research Centre, Thornton-le-Moors, and at other places in recent months.

MR. J. ERIC STEEL, managing director of Steel & Company, Limited, electrical and mechanical engineers, etc., of Sunderland, has returned from a visit to Canada and the U.S.A. with a $5-million order, while Mr. James Steel, assistant managing director of the company, has secured orders to the value of £250,000 during his tour of the Far East. As a result of the new work, the company, which at present employers about 1,600, will raise the number of its workers to 2,000.

MR. M. A. WOLFF, chairman of the Chesterfield Tube Company, Limited, announced at a works dinner that plant is to be installed at the Chesterfield works to make it the most efficient in the world. The company was employing to that end people who had visited America and other countries. Mr. W. Brown, managing director, said the company's output was double in tonnage what it was 12 years ago, four times what it was 25 years ago, and 40 times what it was 40 years ago.

Growth of Scottish Industry

Scotland had the most modern integrated steel plant in Europe and supplied 15 per cent. of British steel, declared Lord Bilsland, president of the Scottish Council (Development and Industry), when he spoke at a recent American Chamber of Commerce luncheon in London. New developments were proceeding which would create three large new coal-mining areas. In light industry Scotland had provided more than 30 per cent. of the watches and clocks in Britain, and nearly all the typewriters. In the north of Scotland great reserves of water power were being harnessed to provide hydro-electric power on a large scale. There was no parallel in her history to the surge of activity and regeneration in progress to-day.

Scotland had always been relatively more concerned in world trade than any other part of Britain, he said—not only for her heavy industries, but throughout the main range of her engineering, textiles, and other industries. Until the first world war Scottish economy had reached a stage of development and activity which compared favourably with all other parts of the country. The steady decline of world trade, the growth of nationalism and the increasing barriers to free exchange after the first world war, clearly demonstrated that in the changed circumstances the Scottish economy rested on too narrow a basis.

Industrial Estates

To-day there were 23 industrial estates in Scotland in which, since the summer of 1945, fresh sources of employment had been provided for 57,500 workers. Between 1937 and 1949 approximately 80,000 new jobs had been provided by fresh industrial development, and when these new projects were in full operation they would give employment to 112,000 workers. The events of the past five years had constituted a minor revolution in Scotland. The new enterprises covered a wide range of light industry, and had gone far to restore the balance of her economy.

The mainstay of her industrial structure would, however, remain in the heavy industries, declared Lord Bilsland, in which progress was being made, in some cases with the help of E.C.A. funds, in re-equipment and development. Although Scotland represented only 10 per cent. of the population of Britain, 41 per cent. of the merchant ships launched in 1948, 48 per cent. of the national output of locomotives, 73 per cent. of water-tube boilers, 62 per cent. of coal-cutting machinery, and 21 per cent. of railway wagons were produced there.

Metal Grinding Regulations

The Minister of Labour has issued draft regulations entitled the draft Grinding of Metals (Miscellaneous Industries) (Amendment) Special Regulations, 1950, which take the place of an earlier draft published last April under the same title. The proposed special regulations amend those made in 1925. The Minister has modified his original proposals made last year following representations by the engineering industry. Further objections to the draft regulations on behalf of persons affected must be sent to the Minister by April 1.

French Steel Output in January

Provisional totals of French iron and steel production for January are as follow, comparative figures for the previous month being given in parentheses:—Pig-iron and ferro-alloys, 691.000 (688 000) metric tons; steel ingots and castings. 779.000 (792,000) tons; rolled products, 539,000 (565,000) tons.

Obituary

MR. THEDFORD DYMOCK, H.M. superintending inspector of factories for Scotland, died in hospital on February 11.

MR. JOHN EDWARD MCINTOSH, who died suddenly on February 20, was managing director of Briggs Motor Bodies, Limited, Dagenham (Essex). He was 55.

ROBERT RUSSELL WALKER, managing director of William Jacks & Company, Limited, died on February 25 in his 80th year. Mr. Walker specially interested himself in the export department of the firm.

MR. ARCHIBALD PARK NEWALL, who died at Perryston, Ayr, last week-end, was chairman and founder of A. P. Newall & Company, Limited, heat-treated bolt and nut manufacturers, of Possilpark, Glasgow. He was in his 70th year.

MR. W. DIETERICHS, who died on February 20 at the age of 54, was appointed manager of the whole of Watson House, the then research and training centre of the Gas Light & Coke Company, in 1945. He retained this position when Watson House was taken over by the North Thames Gas Board.

MR. ROBERT TAYLOR HARDMAN, managing director of Robert Hardman & Bros. (Rockcliffe), Limited, ironfounders and engineers, of Bacup (Lancs), has died at the age of 81. Mr. Hardman had been associated with the company, which was founded by his father and uncle in 1848, for more than 60 years.

DR. WILLIAM PALMER WYNNE, F.R.S., who was Professor of Chemistry at Sheffield University for many years, died at Urmston, Manchester, on February 16. He was 89. He designed the chemical laboratories at Sheffield and built up the University's Department of Chemistry. In 1888 he obtained a post as lecturer on chemistry at the Central Technical College of the City and Guilds of London Institute, remaining there until he was appointed Assistant Professor of Chemistry at the Royal College of Science in 1902. Two years later he began his long association with the University of Sheffield. Prof. Wynne occupied the chair until 1931, when he retired. In 1913 he was elected president of Section B of the British Association and he served for two terms, in each capacity, as honorary secretary and vice-president of the Chemical Society, of which he was president from 1923 to 1925. He was examiner in chemistry for the Universities of London and Birmingham, the Board of Education, and the Institute of Chemistry, and from 1934 to 1943 was a member of the University Grants Committee.

International Conference on Pneumoconiosis

The following were nominated from the United Kingdom to attend an International Conference on Pneumoconiosis, arranged by the International Labour Office, which is at present being held at Sydney, New South Wales, from February 28 to March 11:—Dr. E. R. A. Merewether, C.B.E., M.D., F.R.C.P., K.H.P., H.M. Senior Medical Inspector of Factories, Dr. J. C. McVittie, M.B., Ch.B., member of the Swansea Pneumoconiosis Medical Board, Dr. C. M. Fletcher, M.D., F.R.C.P., director of the Pneumoconiosis Research Unit, Cardiff, and Mr. E. A. Shearing, assistant secretary, Ministry of Fuel and Power.

The agenda of the Conference is listed briefly as follows:—Present stage of knowledge of pathogenesis; clinical aspects and diagnosis of pneumoconiosis; present stage of preventive measures (medical, social, mechanical and technical); and exchange of views as to the possibility of defining minimum international standards of compensation for disability caused by pneumoconiosis.

Elimination of Cracks in Re-entrant Angles by the Use of Chilling

Mr. Georges Blanc, writing in *Fonderie*, first recalls that founders are taking an ever-increasing interest in the question of progressive solidification. It is possible to influence this solidification by the positioning and sizes of the runners and risers, and also, of course, by the use of chills. By such means, one can eliminate draws and cracks, which show up during solidification when casting certain designs of substantial dimensions in bronze. For instance, one can ram-up in the sand forming the mould, red copper wires of 3-mm. thickness, which converge towards the spot liable to cause cracking and which should be staggered in several succcessive layers.

The origin of the defects under consideration arises from a concentration of metal where the solidification and the cooling take place more slowly than the body of the casting on the ends of its sections. The copper wires, being good conductors, favour the removal of the excess heat from the metal junctions towards the outside. This danger zone is then able to withstand the effects produced by solidification and the shrinkage of the adjoining parts. Draws have been eliminated by this method, whilst cracks have practically disappeared or, in the most unfavourable cases, only showed up on the surface of the casting without existing in depth.

The use of massive chills has been considered, but the shape of the casting does not always lend itself to such treatment, and it has been found easier to place copper wire as indicated. Moreover, it is possible that local chills may not be so effective. Again, the wire chills do not lower the permeability of the mould, which under certain circumstances may be important.

A similar result has been obtained by piercing the mould face with blades one or two millimetres thick and 4 to 5 mm. wide. The metal will enter these and will chill back into the body of the casting. If the use of copper wire has been preferred, it is because it does not effect cleaning operations; actually, no trace of the wires appears on the casting.

Industrial Designers in Scotland

The Scottish Committee of the Council of Industrial Design is compiling a register of industrial designers, and already it has been possible to recommend designers to firms engaged in iron founding and other trades. In the nine months or so since the Committee first appealed for designers who wished to be considered for the register, about 60 applicants, men and women, have been considered by a panel of judges. About one-third of the applicants, who are all experienced designers, have been placed on the register.

Applicants who were considered promising, but lacked sufficient experience, have been asked to submit further examples of their work at periods varying from six months to two years. Designers in Scotland who have not already done so are invited to submit examples of their work for consideration so that the register may contain details of men and women skilled in every field of industrial design.

Details of the register can be obtained from the offices of the Scottish Committee of the Council of Industrial Design at 95, Bothwell Street, Glasgow, C.2.

G. CLANCEY, LIMITED, ironfounders, of West Bromwich and Halesowen, celebrated the 25th anniversary of their foundation last week by a dinner given by the firm, which was attended by 240 workpeople and their wives.

European Steel Prospects

Examination of E.C.E. Report Conclusions

A report on prospects of the European steel industry issued recently by the Economic Commission for Europe assessed consumption in Europe by 1953 at 58,000,000 tons and the possible export outside Europe at 4,000,000 tons, making a total demand on European steel industries which might be expected in the form of orders on the books in that year of 62,000,000 tons. The combined production plans of all European nations concerned amount to over 70,000,000 tons, leaving a potential production surplus of 8,000,000 tons.

Commenting on the E.C.E. report in the current issue of its monthly bulletin, the British Iron and Steel Federation points out that the consumption figure of 58,000,000 tons is 14 times as large as the anticipated level of exports. Thus even a small error in the estimate of European consumption, or of European capacity, would radically alter the whole picture, whereas a very substantial increase in European exports above the estimated rate would be necessary to dispose of the surplus.

One of the conditions the E.C.E. report considers necessary for this level of European steel consumption is that steel prices be "kept at a stable low level to induce higher consumption, encourage the substitution of steel for other materials, and to help the European mechanical engineering industry compete in world markets." The Federation says that it is clear, indeed, that in order to achieve a consumption of 58,000,000 tons, many conditions will have to be fulfilled. Some of these conditions are examined in the report and in particular, studies are made of the supply in Europe of the necessary raw materials and of the competitive position of Europe in relation to the United States and overseas markets.

It is admitted, however, by the authors that as a result of the scarcity and "non-comparability" of available data, the comparisons made in this section of the study are "quite precarious."

Effect of Devaluation

The chapter concerned was written before devaluation and therefore its first conclusion (which was incorrect in regard to the United Kingdom in any case) that "the European steel industry is at present at a disadvantage in world competition with the American industry" has been overtaken by events. In any case, the conclusion itself was drawn from figures some of which are both scanty and of themselves misleading.

The Federation's article points out that, for example, the home market steel prices quoted for the United States are "producing point" prices and cannot be directly compared with the delivered prices for European countries. Similarly, comparisons are made relating to particular years (for example, 1936) or to particular products (for example, bars), which do not reflect the experience in the case of other years or products. Moreover, as a result of devaluation and increased U.S. prices, the position has changed substantially in recent months.

Particular emphasis is placed in the report on dual pricing; and it urges the immediate abolition of price discrimination between home and export markets for coal, coke, ore, and steel, which it considers to be largely responsible for high production costs. In this connection the report does not distinguish between two completely different forms of dual pricing.

On the one hand, it may consist of taking advantage of export customers in a period of shortage by charging high prices to the detriment of the long-term market; but equally it can result—as has been the case with British steel—from special efforts to keep prices in domestic markets at a level below that which might be reached under competitive conditions and, therefore, below the world price level.

One of the conclusions reached in the report is that co-ordinated measures should be studied and applied in order to increase steel consumption when signs of under-consumption or recession appear.

The Federation says that whether any one industry can pursue policies which will lead to a quick expansion of its output in the event of a trade cycle recession appearing is doubtful, and it may be that this is essentially a question for national and international policies. In view, however, of the vital importance of reducing the violent fluctuations of demand to which steel has always been particularly subject, any action which industries themselves can take should certainly be worked out constructively and put into operation in support of Government policies directed to the same end.

January's Record Exports

Board of Trade returns for the month of January show that the value of United Kingdom exports in that month reached the all-time record of £175.9 million, which was an increase of £15.5 million over the previous record in November, 1949, and £19.4 million higher than the average for the final quarter of 1949. January contained 26 Customs' working days, and the daily rate of exports was 10 per cent. higher than in December, November, or January of last year, but to some extent the high figure of exports in January reflects a seasonal rise following the Christmas holidays. The volume of exports in January is estimated provisionally at about one-sixth above the average for the year 1949, and roughly one-tenth above the fourth-quarter level.

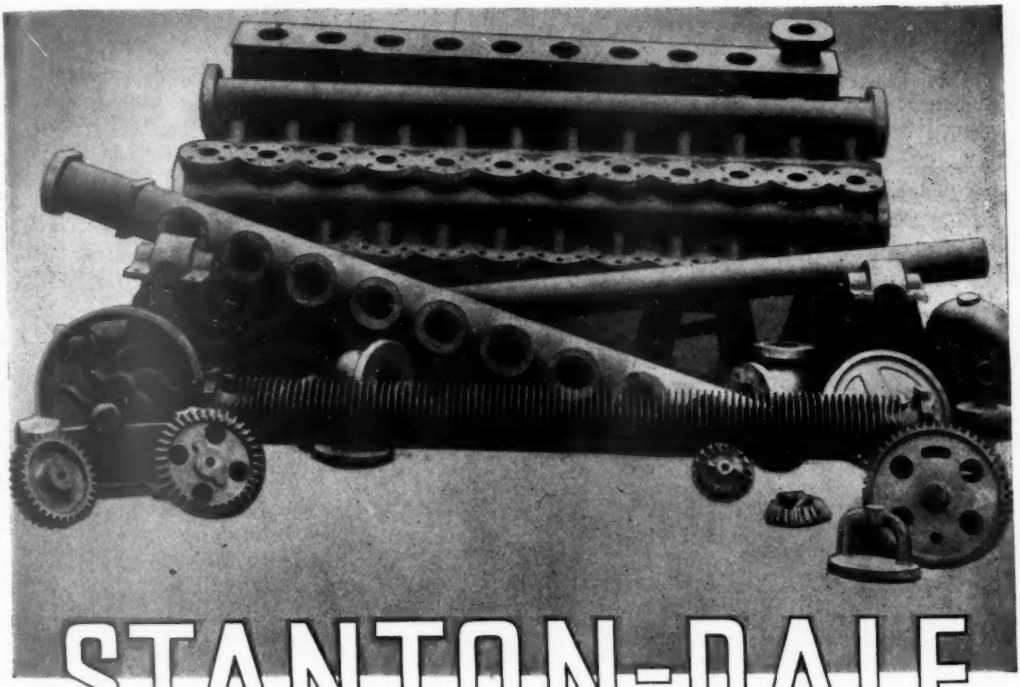
The value of exports of manufactured goods in January (£151.5 million) was 17 per cent. above the average for 1949. Most of the rise was due to a further increase in exports of metals and engineering products, which amounted to £91.7 million—£13.2 million above the fourth-quarter level and £17.2 million above the average for the whole of last year. Exports of iron and steel goods reached £12.5 million in January, 18 per cent. above the average for last year.

Exports of motor-cars were very high in January. The number of cars and chassis exported rose to 30,747 (valued at £9.0 million), one-sixth more than the average for the last quarter of 1949 and over 40 per cent. above the average for the year. Exports of commercial vehicles and chassis increased to 10,267, about one-third above the average for the year 1949; the value was £4.3 million in January. Exports of ships and boats were also very high (100,000 gross tons, valued at £8.1 million).

The rise, compared with 1949, in exports of raw materials (an increase of 45 per cent. to £9.8 million) was due mainly to higher exports of coal and raw wool. The quantity of coal shipped in January (1,428,000 tons, valued at £5.3 million), although a little lower than the average for the fourth quarter of 1949, was nearly one-quarter above the average for the year.

More Canadian Pig-iron

Canadian pig-iron production in 1949 totalled 2,154,352 tons, compared with 2,120,909 tons in 1948. Output of ingots and castings last year was 3,186,930 tons, against 3,201,656 tons in the previous year, while production of ferro-alloys was 211,603 (250,569) tons.



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Imports and Exports of Iron and Steel

Board of Trade Returns for January

The following tables, based on Board of Trade returns, give figures of imports and exports of iron and steel in January. Figures for the same month in 1948 and 1949 are given for purposes of comparison

Total Imports of Iron and Steel

From	Month ended January 31.		
	1948.	1949.	1950.
	Tons.	Tons.	Tons.
Australia	6,495	205	8
Canada	4,703	4,557	3,411
Other Commonwealth countries and Irish Republic	49	39	10,942
Sweden	1,203	2,196	943
Norway	2,013	4,386	2,470
Germany	235	238	7,679
Netherlands	528	6,721	3,232
Belgium	4,101	21,526	4,671
Luxemburg	145	1,447	345
France	218	15,275	29,012
Austria	—	1,068	—
USA	13,388	4,819	4,735
Other foreign countries	1,202	130	1,141
TOTAL	34,280	62,607	68,589
Iron ore and concentrates—			
Manganiferous	—	5,750	—
Other sorts	647,018	548,039	675,751
Iron and steel scrap and waste, fit only for the recovery of metal	47,956	88,416	167,593

Exports of Iron and Steel by Product

Product.	Month ended January 31.		
	1948.	1949.	1950.
	Tons.	Tons.	Tons.
Pig-iron	4	266	2,266
Ferro-alloys, etc.—			
Ferro-tungsten	106	142	79
Spiegeleisen, ferro-manganese	989	604	366
All other descriptions	65	47	324
Ingots, blooms, billets, and slabs	506	60	358
Iron bars and rods	339	633	516
Sheet and tinplate bars, wire rods	654	378	302
Bright steel bars	2,106	2,844	4,158
Other steel bars and rods	11,265	14,442	25,298
Special steel	1,893	1,516	1,412
Angles, shapes, and sections	6,550	9,983	9,889
Castings and forgings	547	655	1,089
Girders, beams, joists, and pillars	2,265	2,325	3,518
Hoop and strip	3,316	5,699	4,597
Iron plate	480	184	428
Tinplates	16,992	16,122	17,992
Tinned sheets	511	554	205
Terneplates and decorated tinplates	80	10	27
Other steel plate (¼ in. thick and over)	8,869	15,071	23,013
Galvanised sheets	5,185	7,345	11,243
Black sheets	8,600	12,952	10,990
Other coated plates	265	422	938
Cast-iron pipes, up to 6-in. dia.	6,980	6,231	7,495
Do., over 6-in. dia.	4,036	5,504	7,449
Wrought-iron tubes	23,695	27,856	29,625
Railway material	12,605	13,818	16,968
Wire	3,557	4,194	5,615
Cable and rope	2,316	2,148	3,189
Netting, fencing, and mesh	1,714	2,190	1,958
Other wire manufactures	473	1,495	1,869
Nails, tacks, etc.	723	807	391
Rivets and washers	669	908	721
Wood screws	570	321	338
Bolts, nuts, and metal screws	1,973	2,516	2,898
Stoves, grates, etc. (excl. gas)	1,055	879	946
Do., gas	286	226	182
Baths	460	673	1,232
Anchors, etc.	791	737	611
Chains, etc.	694	908	872
Springs	381	717	864
Hollow-ware	9,086	7,097	7,578
All other manufactures*	20,872	19,687	22,311
TOTAL	164,523	191,166	232,120

* Figures for 1948 are not completely comparable with those for subsequent years.

Total Exports of Iron and Steel

Destination.	Month ended January 31.		
	1948.	1949.	1950.
	Tons.	Tons.	Tons.
Channel Islands	942	1,018	776
Gibraltar	434	111	149
Malta and Gozo	420	486	496
Cyprus	475	360	189
British West Africa	4,972	3,933	9,352
Union of South Africa	13,590	13,786	9,378
Northern Rhodesia	178	899	2,159
Southern Rhodesia	333	1,968	5,922
British East Africa	7,700	5,008	8,095
Mauritius	411	513	1,104
Bahrein, Koweit, Qatar, and Trucial Oman	1,947	3,026	506
India	4,724	6,418	6,905
Pakistan	1,896	1,642	3,414
Malaya	1,545	4,438	9,138
Ceylon	1,200	1,519	2,820
North Borneo	972	1,940	873
Sarawak	2	217	157
Hongkong	1,320	2,750	4,141
Australia	5,644	9,421	23,615
New Zealand	6,526	8,806	17,509
Canada	916	1,993	7,575
British West Indies	2,217	7,403	4,838
British Guiana	185	393	595
Anglo-Egyptian Sudan	1,296	1,009	1,622
Other Commonwealth countries	803	697	940
Irish Republic	6,125	5,436	5,782
Russia	—	3,466	53
Finland	3,974	8,682	6,137
Sweden	7,487	4,610	6,910
Norway	5,006	6,152	6,320
Iceland	365	527	946
Denmark	8,485	8,160	13,292
Poland	30	108	63
Germany	60	124	58
Netherlands	7,498	10,986	5,239
Belgium	1,057	813	1,039
Luxemburg	977	571	253
France	2,152	3,765	1,073
Switzerland	1,571	1,834	643
Portugal	2,498	1,380	1,082
Spain	511	384	729
Italy	225	142	709
Hungary	34	10	81
Greece	418	308	578
Turkey	1,227	947	871
Indonesia*	3,387	1,454	2,678
Netherlands Antilles	775	350	1,601
Belgian Congo	106	28	103
Angola	6	109	486
Portuguese East Africa	75	516	430
Canary Islands	290	309	156
Syria	90	65	18
Lebanon	521	4,065	905
Israel	3,380	1,193	1,856
Egypt	4,498	5,684	5,372
Morocco	46	21	26
Saudi Arabia	13	655	202
Iraq	3,895	3,899	3,271
Iran	8,080	11,989	11,595
Burma	4,282	1,649	689
Thailand	280	457	679
China	3,473	528	270
Philippine Islands	60	138	1,671
USA	269	898	449
Cuba	404	66	185
Colombia	550	329	422
Venezuela	5,553	6,320	4,817
Ecuador	225	344	364
Peru	744	322	888
Chile	1,450	919	2,112
Brazil	1,257	1,577	3,857
Uruguay	1,082	703	965
Argentine	7,878	7,275	7,592
Other foreign countries	1,506	845	4,276
TOTAL	164,523	191,166	232,120

* Includes Netherlands New Guinea in 1948 and 1949.

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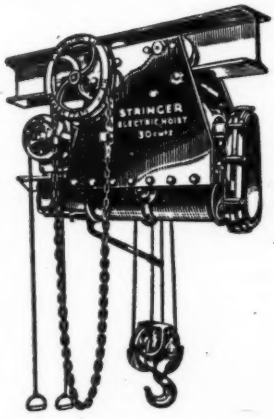

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Raw Material Markets

Iron and Steel

Blast-furnace men are receiving ample supplies of raw materials and their output of pig-iron shows little variation from week to week. There has been an appreciable decline of late in the pressure for light castings, owing to the restrictions on the building trade, and foundries engaged on this class of work no longer experience difficulty in obtaining all the high-phosphorus iron they require. The engineering and speciality foundries, however, are still very busy and are taking up their maximum allocations of low-phosphorus and hematite grades, while refined-iron makers are able to satisfy all requirements at reasonably short notice.

Conditions in the semi-finished steel trade have undergone a marked change since the end of 1949. Confronted with a sharp contraction in demand, Belgian and French producers have been slashing prices in the hope of maintaining outputs, and this has had a disturbing effect on the British market. Sheetmakers continue to absorb very substantial tonnages of sheet bars and slabs, but interest in billets—apart from the smallest sizes—has fallen off and there has been little response to the recent cut of 10s. per ton in the price of defectives.

Rollers of steel plates, especially the thinner gauges, have orders in hand which, in the aggregate, considerably exceed their maximum capacity, and the indications are that these conditions are likely to continue for the greater part of the year. Rollers of heavy joists also continue to enjoy strong support, and the home and export demand for heavy steel rails, chairs, and sleepers assures full employment for producers of this class of equipment. On the other hand, trade in small bars and light sections has taken a quieter turn, but it is hoped that business will regain its former momentum now that the General Election is over.

Non-ferrous Metals

While prices are for the most part steady, tin has shown some weakness, probably due to disappointment over the news that the recent negotiations in Washington about sales to the stockpile had proved abortive. As a result of the American decision to buy tin on the open market, it is probable that purchases during the remainder of this year on account of the stockpile will be maintained at a steady tempo, for from time to time there have been rumours that the ultimate goal is the impressive figure of 300,000 tons. Nevertheless, tin is in over-supply on a world basis, and were it not for artificial support, as for instance the Government's reluctance to sell spot tin below £600, the price would certainly be lower than it is at present.

Metal Exchange tin quotations were as follow:—

Cash—Thursday, £599 to £600; Friday, £599 to £600; Monday, £598 10s. to £598 15s.; Tuesday, £599 to £600; Wednesday, £599 10s. to £599 15s.

Three Months—Thursday, £582 10s. to £583; Friday, £582 10s. to £583; Monday, £582 to £582 10s.; Tuesday, £583 to £583 5s.; Wednesday, £585 5s. to £585 10s.

American copper statistics show that activity is well maintained. Production of crude or blister copper in January was 85,612 short tons, against 80,390 tons in December, while in refined metal the corresponding figures were 95,229 and 94,947 short tons. It will be noted that the increase in output of crude copper was quite substantial. Deliveries to domestic consumers also increased, from 107,662 short tons in December to 111,668 tons in January. Stocks of refined metal in producers' hands fell from 116,027 short tons at the end of 1949 to 101,070 tons at January 31. It is obvious that in order to satisfy current demand imports of foreign copper into the United States must be considerable and, indeed, recent annual figures put those imports at some 428,000 tons. Against this must be set exports of refined copper, totalling about 137,000 short tons.

Company Results

(Figures for previous years in brackets.)

D. NAPIER & SON—Dividend of 7½% (same).

UNITED STEEL COMPANIES—Interim dividend of 2½% (same).

BEANS INDUSTRIES—Final dividend of 27½%, making 37½% (same).

BROWN BAYLEY'S STEEL WORKS—Interim dividend of 4%, tax free (same).

TWEEDALES & SMALLEY (1920)—Final dividend of 15% (20%), making 25% (same).

ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA—Interim dividend of 7% (same) on the preference and ordinary shares.

THOMAS DANKS & COMPANY—Trading profit for the year ended September 30, 1949, £12,644 (£16,177); net profit, after depreciation, etc., £8,132 (£11,720); to reserve for taxation, £4,503 (£6,500); dividend of 7½% and bonus of 2½% (same); forward, £12,035 (£10,111).

J. SAMUEL WHITE & COMPANY—Consolidated trading profit for the year ended September 30, 1949, £138,286 (£133,475); net profit, after depreciation, tax, etc., £31,243 (£31,257); parent company's balance, £71,863 (£69,617); dividend of 12½% (15%); forward, £47,993 (£41,897).

NORTON INDUSTRIES—Consolidated trading profit to October 31, 1949, £116,397 (£91,786); net profit, after depreciation, etc., £89,206 (£69,183); to tax, £47,115 (£38,797); general reserve, £22,000 (£15,000); written off goodwill, £1,291 (off preliminary expenses £1,401); dividends of 20% (same); forward, £8,655 (£3,605).

NOBLE & LUND—Trading profit for 1949, £65,665 (£67,929); net profit, after depreciation, etc., £53,349 (£54,066); proceeds of fire insurance claim, £300 (nil); tax adjustment, £188 (nil); to tax, £26,836 (£29,144); general reserve, £10,000 (same); pension reserve, £5,000 (same); dividend of 42½% (same); forward, £18,631 (£15,527).

BOULTON & PAUL—Group trading profits for the year ended September 30, 1949, £201,279 (£249,654); net profit, after depreciation, tax, etc., £74,465 (£90,087); to assets replacement reserve, £20,000 (£24,000); general reserve, £15,000 (nil); dividend equalisation reserve, nil (£27,500); dividend of 20% (same); forward, £132,589 (£128,049).

WEYBURN ENGINEERING COMPANY—Profit on trading, after all expenses and depreciation, for the year ended October 31, 1949, £56,973 (£64,908); net profit, after tax, £23,814 (£28,693); tax adjustments, £7,997 (nil); to general reserve, £7,000 (£5,000); future taxation, nil (£9,800); tax equalisation, £10,000 (nil); final dividend of 30%, making 35% (same); forward, £4,295 (£3,014).

MIDLAND IRON & HARDWARE COMPANY (CRADLEY HEATH)—Consolidated trading profit, including new subsidiaries, for the year ended July 31, 1949, £301,026 (£263,081); net profit, after depreciation, tax, etc., £132,093 (£117,773); final dividend of 37½% (150%), making 62½% (250% on quarter of present capital); goodwill, £49,914 (nil); general reserve, £70,000 (£50,000); forward, £116,411 (£146,657).

WILLIAM ASQUITH—Consolidated trading profits for the year ended September 29, 1949, £200,123 (£155,553 for 13½ months); balance of profits attributable to parent company, after depreciation, tax, etc., £67,016 (£49,344); amount retained by subsidiary, £11,909 (£11,470); tax reserve release, nil (£4,600); available, £100,815 (£61,538); to general reserve, £15,000 (nil); preference dividend, £7,305 (£8,258 for period); final ordinary dividend of 10% (11⅞%), making 15% (16⅞%); forward, £71,779 (£45,708).

BIRFIELD INDUSTRIES—Consolidated trading profits of subsidiary companies, for the year to August 31, 1949, £1,151,704 (£887,964); net profit of group, after depreciation, tax, etc., £390,072 (£255,310); transfers provision of taxation not required, £41,776 (nil); anticipated loss of materials, £21,196 (nil); sundry unclaimed balances, £5,939 (nil); depreciation, nil (£35,192); available balance, £568,051 (£406,657); to reserve for increased replacement of cost of fixed assets, £90,000 (£55,000); stock and contingencies reserve, £92,000 (£138,000); pensions, £30,000 (nil); deferred repairs, nil (£10,000); unappropriated profit carried forward by subsidiary companies, £254,515 (£109,768); outside shareholders, £17 (nil); profit of holding company, £101,519 (£93,889); to preference dividend, £26,367 net (£27,291); capital redemption reserve, £28,000 (£27,000); preference redemption premium, £1,400 (£1,350); ordinary dividend of 12½% (same); general reserve, £20,000 (£10,000); forward, £104,624 (£97,091).